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IMPERIAL BUREAU OF ENTOMOLOGY.

REVIEW
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APPLIED ENTOMOLOGY.

SERIES A.

VOL. VII.] [1919.

RICHTER (H.). **Ueber Lebensweise und Bekämpfung des Nutzholzborkenkäfers.** [The Life-history and Control of the Timber Bark Beetle, *Xylcterus lineatus*, Oliv.]—*Forstwissenschftl. Centralblatt, Berlin*, xl, no. 7, July 1918, pp. 241–244.

Very little appears to have been published relative to the life-history of *Xyloterus lineatus*, Oliv., hence this record of observations made subsequent to the windbreak disaster in January 1916, in the Bavarian district of which the author was chief forester. The main part of this break was 3 miles in length by 220–330 yards in width and included heavy spruce and fir timber. By August 1916 all the fallen timber over 3 inches in diameter had been barked and stacked, but the stumps could not be barked by that date. In the following year it was noticed that stem wood in felling places about ¾–1¼ mile from the windbreak were more severely infested than usual by *Xyloterus lineatus*, Oliv. An investigation of the windbreak stumps (which had been raised in the summer of 1917 by means of explosives) showed that those in the principal area were only very slightly infested by this beetle and other pests, whereas stumps in the small breaks on either side were attacked by *X. lineatus* to a much greater degree. They appeared to be preferred as breeding places on account of the moisture present, the trunks in the main area being very dry as a result of exposure to sunshine. Further observations made in 1918 on timber under similar conditions seem to confirm the assumption that this beetle is careful in the choice of its breeding place. Preventive and destructive measures must therefore be very carefully applied in the case of small breaks or in areas where natural re-stocking is the practice. In places where there has been no natural re-stocking the speedy removal of stump wood is a good preventive measure; but in those where young growth has already established itself it is necessary that all new stumps should be barked as early as possible, for after a short winter the flight period begins early in March, so that the emergence of the new beetles may be expected early in June. Therefore if felling is done in winter, the stumps should be barked immediately after felling from December to February. In localities where a great increase of *X. lineatus* is feared an efficient preventive

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measure consists in felling during the growing season and barking immediately afterwards. This, however, entails the disadvantage of the greater injuries sustained during the growing period by young growth through felling effected in summer and through the need (which the author regards as imperative where re-stocking is natural) for immediately removing the stumps. For this reason winter felling may be unavoidable. In any case infested and barked stem wood must not be left in the forest for long, because barking is not a complete protection. Furthermore the immediate removal of timber is not sufficient if the sawmill is in the vicinity and the wood is allowed to remain there for several months. It is necessary that the timber be sawn (which facilitates drying) as soon as possible after it is removed from the forest, and this removal must be effected before mid-May at the latest. The use of trap-logs and trap-billets is insufficient for work on a large scale, but they are useful indicators of the amount of infestation. The clearing of forests of all suspicious material must not be neglected.

CHITTENDEN (F. H.). **Control of the Melon Aphis.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 914, February 1918, 16 pp., 8 figs. [Received 29th October 1918.]

The melon aphis [*Aphis gossypii*, Glover] is the most abundant and destructive Aphid affecting melons and cucumbers, and it also attacks pumpkin, wild gourd, winter squash and other cucurbits, cotton, okra, orange and other citrus fruits. Secondary food-plants that are attacked when cucurbits are not available are hops, strawberry, beans, sugar and table beets, spinach, tomatoes, asparagus, several ornamental plants and various common weeds. The pest is widely distributed in many countries and is very general throughout the United States. In Texas, Kansas and Nebraska it is particularly troublesome, especially in the last two States to cucumbers, which are extensively grown for pickling. Soon after the plants have developed leaves the winged Aphids begin to migrate to them from weeds and other vegetation, frequently passing, as their food-plants become exhausted, from one crop to another. *A. gossypii* is fortunately held in abeyance to a great extent and limited to innocuous numbers by natural enemies, of which there are a great many. The number of insect species known to prey upon the melon aphis is about 40. Coccinellids that are of great assistance in control include *Hippodamia convergens* and *Scymnus terminatus*. These insects are active at all seasons, especially at the time of appearance of the aphis. Other enemies are the maggots of certain species of Syrphids, such as *Syrphus ribesii*, which devour large numbers of the Aphids, and the larvae of lace-wing flies. Several minute Hymenoptera are parasitic upon *A. gossypii*, while parasitic fungi also destroy many. The parasites are most effective towards the end of the season. Artificial control is, as a rule, only necessary when the enemies are not present in their usual numbers. A direct contact spray applied to the Aphids on the under-sides of the leaves as soon as infestation begins has been found successful. The formula recommended for the spray is 3 fluid oz. 40 per cent. nicotine sulphate and 1 lb. laundry soap to 25 U.S.

gals. water. A power spray is advisable owing to the low, spreading nature of the vine growth. Kerosene emulsion is less successful as a spray, and may damage the plants. A strong stream of water from a garden hose will wash off many insects. Suitable spraying machines and appliances are described. In small fields fumigation with carbon bisulphide under tubs or other tight receptacles or covers is effectual, 1 drachm (or about a teaspoonful) of the chemical being required to each cubic foot of space. Clean cultural methods are a great help in Aphid control, and all remnants should be collected and burnt as soon as the crop is gathered. Weeds in the vicinity of crops should be kept down throughout the year.

KYLE (C. H.). **How to reduce Weevil Waste in Southern Corn.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 915, February 1918, 7 pp., 3 figs. [Received 29th October 1918.]

A serious obstacle to the increase of profitable production of maize in many localities is the prevalence of insect pests, which have made it impracticable to store the crop until it can be used. Ears with poor shuck coverings are frequently damaged before the maize can be stored, and even if clean when stored, quickly become infested from other sources. Shucks that extend beyond the tips of the ears and close tightly about the silks are weevil-proof both in field and in storage. It is suggested that directly after harvesting the ears should be sorted and poorly protected ears disposed of as rapidly as possible. If it is necessary to store maize with poor shuck protection, the seed should be shucked, shelled, cleaned and put into bags of close-woven cloth. Ears having long, closely fitting shucks should be stored in their shucks, and the best ears of this kind should be selected for the next year's seed.

LUGINBILL (P.). **The Southern Corn Rootworm and Farm Practices to control it.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 950, May 1918, 12 pp., 7 figs. [Received 29th October 1918.]

The life-history and habits of *Diabrotica duodecimpunctata*, Oliv. (southern corn rootworm) have previously been described [see this *Review*, Ser. A, i, p. 430]. Preventive measures advocated in this bulletin against the pest include the burning over of waste places, such as the borders and terraces of fields, in winter and on cool days, when the beetles are congregated among dead grasses seeking protection from the cold. Crop rotation should be practised when possible, and an infested maize field should not successively be planted with maize. Cotton is not injured by the grubs and some of the smaller grains are only slightly damaged. A common practice is to plant maize seed much more thickly in the lowlands than the uplands, to secure a better chance of a crop on the lower ground. The use of commercial fertilisers strengthens the plants and affords a less favourable breeding-place for the pest. In each locality planting should be timed to minimise the ravages of the grubs.

CREEL (C. W.) & ROCKWOOD (L. P.). **The Control of the Clover-Flower Midge.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 971, June 1918, 12 pp., 6 figs. [Received 29th October 1918.]

The life-history and habits of *Perrisia* (*Dasyneura*) *leguminicola*, Lint., have previously been described and its control discussed [see this *Review*, Ser. A, iii, p. 266, and v, p. 325]. The present bulletin gives practical directions to farmers regarding pasturing, early and late cutting of the clover crop, the clipping back of clover between the 10th and 25th May, leaving the clippings on the ground as a mulch, and soiling, *i.e.*, cutting the clover and using it as green fodder during spring and early summer.

WALLACE (E.) & EVANS (L. H.). **Commercial Bordeaux Mixtures. How to Calculate their Values.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 994, June 1918, 11 pp., 1 fig.

This bulletin describes a method by which the strength of commercial Bordeaux mixtures can be calculated in terms of the amount of equivalent copper sulphate in 50 gallons when diluted. Two tables are given by which the strengths can be approximately determined without calculation. Physical properties, such as adhesiveness, texture, spreading quality and rate of settling are also important factors in determining the efficiency of Bordeaux mixtures; some tests in this connection are described.

TEMPANY (H. A.). **Regulations and Syllabus of the School of Agriculture.**—*Mauritius Dept. Agric., Port Louis*, Gen. Ser. Bull. no. 10, 10th June 1918, 10 pp. [Received 31st October 1918.]

The first year syllabus of requirements for diplomas granted by the Mauritius Department of Agriculture includes the following entomological subjects:—The place of insects in the scale of animal life; general characters of insects differentiating them from other animals; the natural orders into which insects are divided, and the diagnostic characters of each order; metamorphosis of insects of each order; the structure and organs of common insects. Identification of the proper order of common insects; life-history and habits of common insects of each order; identification of the various stages of important insects. The relation between insects and agriculture; harmful and beneficial insects; simple treatment of insect pests. Collection, mounting, and preservation of insects; permanent mounting of insects for microscopical examination.

D'EMMEREZ DE CHARMOY (D.). **L'Importation de *Tiphia parallela* de la Barbade à Maurice.** [The Importation of *Tiphia parallela* from Barbados to Mauritius.]—*Mauritius Dept. Agric., Port Louis*, Série Scient. Bull. no. 6, 1918, French Edition, 11 pp., 1 plate, 1 map.

The memoir of which this is a translation has already been noticed [see this *Review*, Ser. A, v, p. 502]. In an appendix the following facts are given:—*T. parallela* was noticed in considerable numbers in two localities in May; during this month the percentage of females

was hardly ever above 5, but in July it rose to 20 per cent.; from one of the above-mentioned localities many females were taken and liberated in other parts where their presence had not already been proved; the ease with which this species has become acclimatised and the rapidity with which it multiplies and spreads, it being present in some districts actually in great numbers, encourage the hope that it may effectually control *Phytalus smithi.* Experiments have shown that the presence of the plant, *Cordia interrupta,* is essential to the existence of *T. parallela* and *Scolia rufa,* and it also strongly attracts the adults of *P. smithi,* which may then be easily captured.

DUDLEY (F. H.). **A Few Insects and Diseases Common to Small Fruits.**—*Bull. Maine Dept. Agric., Augusta,* xvii, no. 3, September 1918, pp. 22–27.

The insect pests attacking the raspberry in the United States are:—(1) Raspberry cane-borer [*Oberea bimaculata*], the female beetle girdling the young tips by cutting two rings round the shoot about an inch apart, between which the egg is inserted. The young larva burrows downwards through the pith, the life-cycle of the insect taking 2 or 3 years to complete. The pest may be effectively controlled by cutting off the drooping tips below the point of injury, and in the event of the whole canes dying, they should be cut in late summer before the larvae reach the base to hibernate. (2) Raspberry saw-fly [*Monophadnus rubi*], which oviposits beneath the skin of the leaves and close beside the ribs. Spraying or dusting with hellebore has been known to exercise effective control. (3) Raspberry-cane maggot [*Phorbia rubivora*], a fly much resembling the common house-fly, which oviposits in the fork at the base of the top leaves, soon after the young canes start in the spring. The larva burrows downwards in the pith for a short distance and then girdles the cane inside the bark, causing the upper part to wilt and die. The larva bores downwards, pupates and hibernates near the base of the cane, the adult emerging the following spring. The pest may be controlled by gathering and burning the wilted tops, and cutting out any infested canes containing pupae.

Blackberries are attacked by the giant root-borer [?], the adult beetle appearing about the middle of July, and often doing much damage before being discovered, as it usually flies at night.

REDDICK (D.). **Dusting, a Substitute for Spraying in the Apple Orchard.**—*Bull. Maine Dept. Agric., Augusta,* xvii, no. 3, September 1918, pp. 52–59.

The greater part of the subject matter of this paper has already been noticed [see this *Review*, Ser. A, iv, p. 181]. The practical experience of growers conducting tests on a commercial scale during 1916 and 1917 was that neither dust nor spray gave satisfactory results, since both seasons were unusually favourable for the development of scab, and most unfavourable for work in the orchard. These two years of practical work indicate that dusting may become a common practice in New York. The reasons for such a prediction are:—The scab disease is subject to great fluctuations, and during the past

two years it has been more severe than during the previous twenty years; chewing insects are usually better controlled by the use of dry poison, but, not being abundant in 1916–17, their control could not counterbalance the poorer control of scab; if under such conditions growers are satisfied with the results obtained, they will be better satisfied in years when scab is not so abundant and when insects are likely to be more prevalent; the method of applying dust is not well understood, and the dust machines now in use may be open to as much improvement as the old barrel sprayer was; the dust method makes it possible for any grower to follow a new schedule for orchard protection, consisting of light treatments at more frequent intervals, it being possible to make an application of dust to the entire orchard before the condition actually permitting infection arrives; the great saving of time effected by dusting makes growers anxious to experiment in the hope of finding improved methods.

In the opinion of the author the factor most likely to determine the future success or failure of dusting is the discovery or non-discovery of dry, contact insecticides, since at present a spray machine must be kept for use against scale-insects, Aphids and red bugs.

In the discussion that followed, the points most emphasised were the immense saving in time and labour effected by dusting, and the great adhesive qualities of a mixture of 85 parts sulphur and 15 parts lead arsenate.

BAKER (A. C.). **Another *Toxoptera* feeding on Sedge (Homoptera; Aphididae).**—*Psyche, Boston, Mass.*, xxv, no. 4, August 1918, pp. 88–93. [Received 31st October 1918.]

Toxoptera nigra, sp. n., is described. Apterous forms of this Aphid were found on sedges growing in marshy land in the District of Columbia and the species is described from individuals reared from these.

DE SEABRA (A. F.). **Observations sur quelques Espèces de Cochenilles du Portugal.** [Observations on some Species of Coccids from Portugal.]—*Bull. Soc. Portugaise Sci. Nat., Lisbon*, viii, no. 1, 1918, pp. 72–81.

An account is given of the COCCIDAE of Portugal. Twenty-six species, of which three are unidentified, are mentioned. These are:—*Icerya purchasi*, Mask., which is checked to a large extent by *Novius cardinalis*, imported from America; *Pseudococcus* (*Dactylopius*) *citri*, Risso; *P. adonidum*, L. (*D. longispinus*, Targ.), which was considered to be the cause of a heavy infestation of the elm trees in the streets of Lisbon, and for which several insecticides have been tried without success; *Orthezia urticae*, L., apparently not very numerous or harmful; *Kermes roboris*, Fourc. (*variegatus*, Gmel.); *Lichtensia viburni*, Sign.; *Pulvinaria vitis*, L.; *P. camelicola*, Sign; *Ceroplastes rusci*, L., found wherever figs are grown in Portugal and frequently destroyed by the Coccinellid, *Chilocorus renipustulatus*; *Coccus* (*Lecanium*) *hesperidum*, L.; *Saissetia* (*Lecanium*) *hemisphaerica*, Targ.; *S. oleae*, Bern.; *Lecanium signiferum*, Green?; *Aspidiotus camelliae*, Sign.; *A. cydoniae*, Comst.; *A. palmae*, Morg.; *A. hederae*, Vallot, which is injurious to olive trees; two unidentified species of *Aspidiotus*;

Chrysomphalus (*A.*) *dictyospermi*, Morg., *Aspidiotus* (*Diaspis*) *ostreaeformis*, Curtis; *Diaspis boisduvali*, Sign.; *Aulacaspis rosae*, Bch., very injurious to rose trees, which should have the infested shoots destroyed; an unidentified species of *Lepidosaphes*, injurious to pine foliage; *Lepidosaphes* (*Mytilaspis*) *ficus*, Sign., *L. beckii*, Newm. (*M. citricola*, Pack.), which is abundant on oranges; and *Chionaspis aspidistrae*, Sign. A complete list of the known food-plants of each species is given, with notes concerning some of them.

MARTIN (W. H.). **Dissemination of *Septoria lycopersici*, Speg., by Insects and Pickers.**—*Phytopathology, Baltimore, Md.*, viii, no. 7, July 1918, pp. 365–372.

Studies to determine the methods of dissemination of the causal organism (*Septoria lycopersici*) of tomato leaf-spot were made during the summer of 1917, insects being suspected as possible factors.

It was found that in New Jersey the tomato is visited by both the adults and larvae of *Leptinotarsa decemlineata*, Say (Colorado potato beetle), by *Epitrix cucumeris*, Harris (flea-beetle), *Protoparce carolina*, L. (tomato worm), and *Aphis pseudobrassicae*, Davis, in large numbers, all these being present in the field until late in the season. Observations indicated that early blight (*Alternaria solani*) of tomatoes is disseminated by flea-beetles, the punctures made by which become centres of early blight infection, the spores being carried either by the beetles themselves or by the wind.

During the later part of the season when the disease became more prevalent, all insects examined, whether taken from diseased or healthy leaves, were found to carry spores.

Examination of insect excreta showed that they invariably contained spores, instances being noted where those of *S. lycopersici* and *A. solani* were germinating, thus proving that alimentation does not destroy their viability. This fact is important, since it explains how spores thus carried may be distributed over a wide area, whereas those on the bodies of insects are carried only a short distance.

It was also established that insects feed on the diseased leaves, though it is not supposed that they attack these in preference to healthy ones. It has been shown, however, that the beetle, *Leptostylus macula*, Say, feeds on the pustules of the chestnut blight fungus.

Examination of the material adhering to the hands and garments especially of those working in heavily infected fields showed the presence of large numbers of spores, which accounts for the commonly observed fact that the disease becomes particularly severe after the second picking, which takes place about a week after the first. The obvious remedy for this is to delay picking after a rain or heavy dew until the plants are dry, this being specially important in the case of the first picking.

D'EMMEREZ DE CHARMOY (D.). **Report on the Work of the Division of Biology.**—*Ann. Rept. Dept. Agric. for 1917, Mauritius*, p. 11. [Received 31st October 1918.]

Several attempts to introduce a stock of the Eri silkworm [*Attacus ricini*] into Mauritius from India have failed owing to delays during transit.

Several Scoliid wasps have been introduced, including *Scolia oryctophaga*, which has been imported from Madagascar as an enemy of *Oryctes tarandus*.

Tiphia parallela has spread over a much larger area than that covered in the previous year, and in May and June it was systematically distributed to spots where it had not been previously established. The number of individuals of *Phytalus smithi* destroyed was nearly the same as for 1916, the total being 73,503,579 against 71,320,870 in 1916. The expenditure involved in 1917 was about £1,350 against £1,510 for the preceding year.

Annual Report Yakima County Horticultural Department for 1916. —*North Yakima, Wash.*, 74 pp., 3 figs. [Received 31st October 1918.]

The introduction to this report contains a general survey of pests and diseases during the year. San José scale [*Aspidiotus perniciosus*] is one of the most serious pests in the Yakima Valley; lime-sulphur and oil are used in its control, but it is a difficult pest to deal with. Aphids have been very troublesome, but can be controlled with adequate spraying. Distillate oil emulsion is recommended for trial against Aphids, and is considered economical and efficient. This spray is also recommended for the control of red spider [*Tetranychus*]. The pear-leaf blister mite [*Eriophyes pyri*] is seldom troublesome where lime-sulphur is used late in the spring. Against leaf-hoppers sprays of nicotine solutions or distillate oil emulsions are advised, to be used when the insects are in the nymphal stage. The strawberry root weevil [*Otiorrhynchus ovatus*] has recently appeared. Carbon bisulphide has been found the most effective insecticide against it. Ploughing up the plants is not recommended, as this has the effect of scattering the insect over the surrounding country. The Colorado potato beetle [*Leptinotarsa decemlineata*] was found in 1916 in 17 different potato fields. Prompt measures were taken, including spraying with lead arsenate to kill the larvae, and hand-picking the adults, 3,000 beetles being collected by this method.

The codling moth [*Cydia pomonella*] was the cause of many investigations, including the determination of dates for spraying, trials to test the relative efficiency of various substances used as sprays, the relative merits of which are compared, breeding work throughout the year, and experiments with nicotine sulphate sprays.

Annual Report District Horticultural Inspector, Yakima County, for 1917.— *North Yakima, Wash.*, 54 pp., 1 plate. [Received 31st October 1918.]

San José scale [*Aspidiotus perniciosus*] did not appear to increase during the year 1917. Thoroughness in application of sprays is the essential point in controlling this pest. The codling moth [*Cydia pomonella*] on the other hand caused far greater injury than in the previous year. It is considered that part of this loss might have been prevented by the growers, but climatic conditions were undoubtedly in favour of the moth. Aphids were less troublesome than in the previous year, possibly owing in part to a high degree of parasitism

of the eggs and to the cold spring. The woolly aphis [*Eriosoma lanigerum*], however, was very injurious and appears to be increasing; climatic conditions have favoured this species and a numerous spring generation is probable. The Colorado potato beetle [*Leptinotarsa decemlineata*], which caused much alarm by its sudden appearance in the previous year [see preceding paper], was apparently successfully exterminated, and has made no further appearance.

Special papers are devoted to the question of spray materials and machinery, experimental work, codling moth investigations, etc. Dust spraying has been tried to some extent, but more detailed work is required before this method can be definitely recommended in preference to liquid spraying.

Report on Operations under the Horticultural Inspection Law.—*Bull. State Entomologist Nebraska, Lincoln*, no. 5, 10th April 1917, 15 pp. [Received 2nd November 1918.]

The following insects were intercepted during 1915–1917:—Eggs of the European tussock moth [*Orgyia antiqua*] on *Tamarix*; Carabids and Staphylinid beetles from Holland; *Aleurodes* spp. on azaleas from Belgium; Aphids on *Berberis*, azaleas, hydrangeas and pears; *Aspidiotus hederae* on palms: *Lepidosaphes ulmi* on *Buxus*; and *Lecanium* sp. on spruce.

SWENK (M. H.). **How to fight Grasshoppers.**—*Bull. State Entomologist Nebraska, Lincoln*, no. 6, 12th June 1918, 3 pp., 1 fig. [Received 2nd November 1918.]

SWENK (M. H.). **Grasshopper Control.** — *Nebraska Coll. Agric., Lincoln*, Emergency Bull. no. 17, 25th July 1917, 4 pp. [Received 2nd November 1918.]

The first of these is a popular bulletin giving some practical suggestions as to the use of poison-baits for killing grasshoppers and describing the construction of a hopperdozer for collecting the insects from the fields. Owing to the present difficulty of obtaining wheat bran, the following alternative is suggested: lucerne meal 15 lb., Paris green 10 oz. (or white arsenic 1 lb.), cattle molasses 1 U.S. gal., squeezed and ground up lemons 4, water 6 U.S. gals.

The second bulletin, issued in view of the heavy infestation of grasshoppers expected in Nebraska in the summer of 1918, gives directions for the preparation and application of poison-baits and describes the construction and use of the hopperdozer.

SWENK (M. H.). **The Sugar-beet Webworm and its Control.**—*Bull. State Entomologist Nebraska, Lincoln*, no. 7, 24th August 1918, 16 pp., 4 figs. [Received 2nd November 1918.]

The most injurious insect in Nebraska during 1918, apart from grasshoppers, was *Loxostege sticticalis* (sugar-beet webworm). The loss caused by the first generation alone throughout the State has been estimated at about £30,000. The outbreak was preceded by heavy flights of moths from 24th May to 13th June. Early in June eggs were laid on pigweed, lamb's quarters and Russian thistle, and in beet and lucerne fields. By 18th June the caterpillars

were present in enormous numbers and doing great damage to sugar-beet and lucerne crops. Injury by this brood ended about 26th June, and circulars were distributed warning growers to take measures against the heavy infestation expected from the next generation in August and September. There are three complete generations during the year in Nebraska, with a partial fourth in late autumn, these generations overlapping considerably. The larvae of the third generation enter the ground and remain there until the following spring; a few of them pupate and emerge during late September, forming the fourth generation. The life-history and habits of the moth are described. A Braconid, *Cremnops* (*Disophrys*) *vulgaris*, Cress., parasitises the larva or pupa of *L. sticticalis* and is a very effective check on the webworm, its activities being, however, somewhat lessened by an Ichneumonid hyperparasite, *Mesochorus agilis*, Cress.

Remedial measures are discussed. A collecting machine, modelled on the hopperdozer, is described and illustrated. A single sweeping of a field resulted in the collection of about 20 per cent. of the webworms, but had a tendency to break the leaves of the best plants; the apparatus should be used during the hottest part of the day, when the leaves are driest and least liable to break.

Swenk (M. H.) & Wilcox (E. M.). **Spraying Potatoes for Insects and Diseases.**—*Nebraska Coll. Agric., Lincoln,* Emergency Bull. no. 10, 25th May 1917, 4 pp. [Received 2nd November 1918.]

This bulletin discusses the usual methods of control for the Colorado potato beetle [*Leptinotarsa decemlineata*], which is the principal insect enemy of potatoes in Nebraska.

Swenk (M. H.). **Controlling Insect Pests of the Garden.**—*Nebraska Coll. Agric., Lincoln,* Emergency Bull. no. 15, 30th June 1917, 4 pp. [Received 2nd November 1918.]

The usual remedial measures for the commoner insect pests of garden vegetables are described in this popular bulletin.

Caesar (L.). **The Fruit-tree Leaf-Roller** (*Tortrix argyrospila*).—*Canadian Entomologist, London, Ont.,* l, no. 10, October 1918, pp. 321–323.

Tortrix argyrospila has only been noticed in Ontario in the case of three bad outbreaks that occurred almost simultaneously about six years ago. These were in the counties of Northumberland, Wentworth and Norfolk, and it is noteworthy that all surrounding orchards in each locality have remained practically free from the pest, which is restricted almost exclusively to the localities in which it first appeared. Arsenical sprays were tried without much success. Scalecide proved much more effective, but is an expensive material. In one locality natural factors, including parasites, disease and unfavourable weather, gradually controlled the pest, while in another district they failed to do so although the miscible oil spray was continued for another season. In Norfolk county, where the leaf-rollers persisted, there were at least two species of Dipterous parasites and four or five species of Hymenoptera, though it is possible that cold weather may

have retarded the larval development of the parasites and thus rendered them less effective. When fruit-growers are convinced that *T. argyrospila* is present on their trees they should spray thoroughly with a good miscible oil a few days before the buds burst, and this treatment should be used for two years in succession. It is pointed out that *T. argyrospila* (fruit-tree leaf-roller) is frequently confused with *T. rosaceana* (oblique-banded leaf-roller), which greatly resembles it in the larval stage, though the adults are easily distinguishable.

FERRIS (G. F.). **Notes on Coccidae. II. (Hemiptera).** — *Canadian Entomologist, London, Ont.*, l, no. 10, October 1918, pp. 323–332.

Many species of Coccids have been included in the genus *Sphaerococcus* that do not properly belong to it, and the author erects two new genera allied to *Kuwanina*, Ckll. These are *Ehrhornia*, which includes *E.* (*Sphaerococcus*) *cupressi*, Ehrh., and *E. graminis*, sp. n., found in cracks and beneath scales on the root stock of an undetermined species of perennial grass in California, and *Paludicoccus*, of which the type is *P.* (*Sphaerococcus*) *distiхlium*, Kuw.

Callococcus is another new genus founded for *C.* (*Sphaerococcus*) *pulchellus*, Mask., and *Mycetococcus* is erected for *M.* (*Cerococcus*) *ehrhorni*, Ckll., and *M.* (*Cerococcus*) *corticis*, Towns. *Pollinia ovoides*, Ckll., is placed in the genus *Cerococcus*.

YAMADA (Y.). **Minami Manshu ni okeru Kansai no Gaichu.** [Insects injurious to Beet in South Manchuria.] — *Nojishikenjo Iho.* [*Bulletin of the Agricultural Experiment Station*], *Koshurei, South Manchurian Railway Company*, no. 4, April 1, 1918, 32 pp., 3 plates, 1 map.

This report records the injurious insects obtained from beet gardens along the lines of the South Manchurian Railway Company from June to the autumn of 1917.

The following insects are described:—*Agrotis ypsilon*, Rott., burrows one or two inches into the ground near the root by day and attacks the leaf-stalks at night. Plants may be protected from it by means of trenches in which pans containing petroleum are placed. *Agrotis tokionis*, Butl., is also present but is less injurious. *Laphygma exigua*, Hb., passes the winter underground in the pupal state, the adult appearing and ovipositing in the following spring. The eggs are laid mainly on the under-side of the leaf in masses of 30–80. The young larvae are gregarious at first, but later become scattered over both surfaces of the leaves. When present in abundance, whole fields may be entirely defoliated. The adult beetles of *Aserica* (*Serica*) *orientalis*, Mots., appear in the middle of May and continue to be injurious until July, when they gradually disappear. They hide during the day under the plants or in the ground and begin to feed about 5 p.m. Rotation of crops is the best remedial measure. The grubs of a species of *Holotrichia* attack the root of young beets about 3 inches below the surface. An undetermined Elaterid, which passes two or more years in the larval stage, attacks the root. When mature, it pupates in the soil. The adult appears in May or June, the eggs being deposited in the ground. This formidable pest may be trapped

with baits of rice-bran. The adult of *Epicauta megalocephala*, Gbl., appears in June and occurs until July. It eats the leaf, but leaves the veins. Beating is recommended as efficacious against it. An undetermined Curculionid does slight damage to the foliage in one locality. Another weevil, *Amystax maculatus*, Mats., is also a minor pest. *Cneorhinus globatus*, Hbst., appears in March and becomes still more numerous in April and May. It is a serious pest, destroying both leaves and buds and frequently killing the plants.

SASAKI (C.). **Sanji no Joran Enka go ni okeru Kyoso no Sei-iku.** [The Development of the Silkworm Parasitic Maggot after its Eggs are swallowed by the Silkworm.]—*Sangyo Shiken Hokoku* [*Report of Sericultural Experiments*], *Sericultural Experiment Station, Tokyo*, Vol. iii, no. 7, 15th October 1918, pp. 377–396, 3 plates.

As is well known, the egg of the Tachinid silkworm parasite, *Crossocosmia sericariae*, Rond., is first deposited upon the mulberry leaf, is then swallowed with the leaf tissue by the silkworm and hatches out in the alimentary canal, subsequently penetrating into the ganglia of the nervous system of the host. The author has studied, and here describes, the actual process. In 10 minutes after swallowing, some of the eggs have hatched. After 20 minutes the great majority of the eggs have hatched and the larvae travel through the alimentary canal into the body cavity, wandering about between the canal and the nerve cord. After 30 minutes some are endeavouring to penetrate the ganglia, while others are wandering about among the muscular or fat tissues. After 1 hour some individuals have penetrated the ganglia or nerve cord. After 3 hours most of the larvae have penetrated into the ganglia (mainly the 5th and 6th) and a few are found within the cord. After 5 hours almost all have penetrated into the ganglia, some of which may contain as many as six individuals and consequently become greatly swollen. After 8 to 15 hours all the larvae are inside the ganglia. After 40 hours they all remain in the same situation and are quite undeveloped. After 100 hours they have begun to develop so that each infested ganglion becomes about four times the normal size. After 149 hours they have developed considerably and some individuals are leaving the ganglia. After 197 hours they have all left the ganglia, which by this time are totally destroyed, and at this stage they burrow into the tracheae near the spiracles, this area becoming dark in colour when seen from above. After 245 hours the host silkworm may pupate. At this stage the number of parasitic larvae has greatly diminished, owing to the lack of food or for other reasons, and usually only one fully developed individual survives.

Province of British Columbia Department of Agriculture. Twelfth Annual Report for the Year 1917.—*Victoria, B.C.*, 1918, 132 pp., 20 plates. [Received 7th November 1918.]

Areas infested with codling moth [*Cydia pomonella*] have been carefully quarantined and measures against this pest in those areas have been thoroughly carried out. Spraying was done two or three

times, trees were banded and the bands inspected several times during the larval and pupal periods, the rough bark was scraped off the trees, all infested fruit was destroyed by boiling and the good fruit was carefully inspected before being sold. The results have been encouraging, only 10 per cent. of the larvae recorded in the previous year being found in some localities. The life-history of this pest has been studied and much important information obtained.

The control of the pear thrips [*Taeniothrips inconsequens*] has been continued on the same lines as in the previous season, with very good results [see this *Review*, Ser. A, v, p. 70]. During 1917 it was found that this thrips, besides being a pest of deciduous fruit-trees, had become thoroughly established on many native trees and shrubs on Vancouver Island, including the broad-leaved maple (*Acer macrophyllum*), June-berry (*Amelanchier florida*), willow (*Salix scouleriana*), red-flowering currant (*Ribes sanguineum*), choke cherry (*Prunus demissa*), and incidentally on ornamental shrubs, on weeds and on Douglas fir (*Pseudotsuga taxifolia*). Its life-history can be completed on the broad-leaved maple and other trees, which it damages in exactly the same way as fruit-trees. Black-currant plantations have been carefully inspected for the bud-mite [*Eriophyes ribis*] and a number of infested bushes have been destroyed. The mite has recently been discovered on the native currant and therefore its eradication is no longer considered possible. The strawberry-root weevil [*Otiorrhynchus ovatus*] has been troublesome, but growers hope to keep it in check by means of rotation, short-cropping and by delaying the ploughing of the beds until the insects have laid their eggs. The peach twig borer [*Anarsia lineatella*] has been increasing and has caused considerable loss to growers of apricots and peaches. A spray of lime-sulphur (1 : 9) when the buds were swelling gave good results. Grasshoppers and wireworms did great damage during the year, but were controlled by poison-baits. The woolly aphis [*Eriosoma lanigerum*] is increasing in some localities and requires very thorough measures to keep it in check.

An account of the quarantine work carried out during the year is given. Stringent measures are being taken to keep the Province free from such pests as *Bruchus pisorum* (pea Bruchid) and *B. obtectus*, Say (*fabae*, Ril.) (bean Bruchid), all peas and beans being thoroughly inspected before entry and fumigated when necessary. As a protection against *Phthorimaea operculella* (potato tuber moth), the importation of Californian potatoes into Canada is prohibited, while fresh fruit and vegetables from the Hawaiian Islands have been prevented from entry into Canada as a precaution against *Ceratitis capitata* (Mediterranean fruit-fly). *Ephestia kühniella* (Mediterranean flour moth), *Plodia interpunctella* (Indian meal moth), *Tribolium confusum* (flour beetle), the Angoumois grain moth [*Sitotroga cerealella*], *Tenebrio molitor*, *Calandra oryzae* and *C. granaria* have all been imported during the year with rice, peas, beans, etc. for storage. These insects do not apparently survive confinement in a cold storehouse. During the last twelve years all such infested shipments have been fumigated before being put into storage. The Vancouver rice-millers protested against the expense of rice fumigation, which they considered unnecessary, as it was claimed that all infection was destroyed in the process of milling. A special concession was therefore made allowing

them to mill certain infested rice direct from the wharf or a quarantined warehouse, and immediately send the empty sacks to the fumigating station. It is hoped shortly to obtain more valuable results from cold-storage experiments regarding rice-infestation.

WESTER (P. J.). **The Coconut, its Culture and Uses.**—*Philippine Agric. Review, Manila*, xi, no. 1, 1918, pp. 5–57, 19 plates, 6 figs. [Received 1st November 1918.]

This paper gives a list of the chief insect pests of the coconut, the majority of which have already been recorded [see this *Review*, Ser. A, ii, p. 689, & iv, p. 148].

The two most destructive pests in the Philippines are *Oryctes rhinoceros*, L., (rhinoceros beetle) and *Rhynchophorus ferrugineus*, Oliv. (coconut red weevil).

The life-history of the former and its damage to coconuts are described, and recommendations are given for its control [see this *Review*, Ser. A, vi, p. 259].

For the latter [see this *Review*, Ser. A, v, p. 326 & 499], the author recommends traps for the adults consisting of other native palms, the trunks of which should be cut up in convenient lengths and split and placed with small piles of rubbish about the infested area. Each morning the beetles thus trapped should be collected and killed. After two weeks' exposure the bait should be burnt in order to kill the larvae that may have developed from eggs laid in it.

For leaf-eating pests a poison spray is recommended of 1–5 lb. lead arsenate, with an equal quantity of quicklime, to 20 gals. water. Contact sprays such as kerosene emulsion, resin wash or lime-sulphur might also be used. Handpicking should be practised where spraying is impossible. Locusts occasionally attack coconut trees when cereal crops fail them.

A list is given of the Aleurodids and Coccids infesting the coconut. The most dangerous of these, both in the Philippines and elsewhere, is *Aspidiotus destructor*, Sign. Others include *Aleurodicus cocois*, Curt. (*destructor*, Quaint.) and the scale-insects, *Selenaspidus* (*Aspidiotus*) *articulatus*, Morg., *A. cocotiphagus*, Marl., *A. cydoniae punicae*, Ckll., *A. lataniae*, Sign., *A. palmae*, Ckll., *Asterolecanium lineare*, Lindl., *Ceroplastes actiniformis*, Green, *Chionaspis candida*, Banks, *Chrysomphalus aonidum*, L., *C. aurantii*, Mask., *C. personatus*, Comst., *C. propsimus*, Banks, *Coccus acutissimus*, Green, *Diaspis boisduvali cocois*, Licht., *Fiorinia fioriniae*, Targ., *Furcaspis oceanica*, Lind., *Hemichionaspis aspidistrae*, Sign., *H. minor*, Mask., *Lepidosaphes gloveri*, Pack., *L. unicolor*, Banks, *L. mcgregori*, Banks, *Pinaspis buxi*, Bch., *Pseudococcus cocotis*, Mask., *P. virgatus*, Ckll., and *P. pandani*, Ckll. These scale-insects are generally kept in check by their natural enemies, even *Aspidiotus destructor* only appearing in sporadic outbreaks. When necessary the contact sprays referred to above should be used once or twice at intervals of about three weeks. The more seriously infested leaves should be cut away and burned.

The flowers and young fruits of the coconut are practically free from destructive pests. The Pentatomid bug, *Axiagastus cambelli*, Dist., described from the Solomon Islands, is an exception, and when it appears in dangerous numbers should be treated with the same sprays as for scales.

Various directions for spraying are given with descriptions of apparatus and formulae. For kerosene emulsion, 7½ U.S. gals. kerosene to 2½ lb. hard soap dissolved in 4 U.S. gals. water is recommended. For resin wash, 90 lb. resin, 22½ lb. caustic soda (98 per cent.), 1½ U.S. gals. fish-oil, 75 U.S. gals. water. For self-boiled lime-sulphur, 30 lb. quick-lime with an equal quantity of sulphur to 100 U.S. gals. water is advocated.

Otanes y Quesales (F.). **The Bean Fly.**—*Philippine Agriculturist, Los Baños*, vii, no. 1, August 1918, 27 pp., 5 plates. [Received 11th November 1918.]

Agromyza destructor, Malloch (bean-fly) has been doing such damage to growing beans at the College of Agriculture that it is considered likely to become one of the most injurious pests of beans. It was first noticed in 1912, but had probably attacked native beans previously both there and in other localities.

Other species of great economic importance have been reported from other countries. In Australia, *Agromyza phaseoli*, Coq., mines the stems of growing bean plants and in Ceylon the same species often causes the complete failure of the bean crop. In India, *Agromyza* sp. injures the stems of growing peas, and in the United States, *A. simplex*, Lw., occasionally destroys asparagus by mining the stem. In Java, *A. sojae*, Zehnt., is reported as damaging *Soja, Vigna* and *Phaseolus* by boring into the stem.

The adult flies of *A. destructor* are most abundant at the time of appearance of the first two leaves of the plants. The female punctures the leaves for feeding purposes and also inserts the eggs in these punctures. The eggs hatch in two days, the larvae mining under the epidermis on the under-side of the leaves. After a day or two the larvae begin to travel down the stalk, feeding just under its skin. The base of the stalk just above and below the surface of the ground frequently contains several such mines, the result being the decay and eventual death of the plant. The petioles of the leaves and some parts of the skin swell and rupture under the attacks of the larvae. Pupation generally takes place at the base of the stalks under the dried skin. The life-cycle occupies an average of 21 days, being slightly lengthened from December to February, doubtless owing to cold weather. Serious damage is caused only when the plants are young. A set of nine tables records the injury to various plantings of beans and cowpeas. The kidney bean (*Phaseolus vulgaris*) and the cowpea (*Vigna sinensis*) are the species preferred for attack, 100 per cent. being frequently damaged in infested areas. An average of 200 eggs is laid by one female, all plants accessible being attacked by one individual. *Phaseolus lunatus* is the most resistant bean observed, and is only attacked at the time of appearance of the first two leaves; *Dolichos lablab* and *Phaseolus mungo* are also resistant, but to a less degree. The following plants are apparently immune:—*Psophocarpus tetragonolobus, Centrosema plumieri, Canavalia ensiformis, Cyamopsis psoraleoides Stizolobium lyoni* (velvet bean), *Glycine hispida* (Soy bean) and *Cajanus indicus.* Flies have been observed abundantly wherever young susceptible varieties are growing, indicating that they are present in approximately the same numbers throughout the year.

January to April is considered the worst season for larval attack, and cowpeas or kidney beans planted during these months have but little chance of surviving. If planted during the rainy season, they produce heavy vegetation, but bear few pods. The best time for planting is therefore during October and November, when the plants get sufficient moisture to grow rapidly at the start, and are thus able to resist attack.

The methods of study of the life-history of *A. destructor* are described and tables are given recording the length of the various stages reared; nine generations were bred in the insectary from 23rd July 1917 to 22nd February 1918. Two Hymenopterous parasites that assist in the control of *A. destructor* are the Chalcidids, *Eurytoma poloni* and *Paratrigonogastra stella*, which are described. The percentage of parasitism was observed to average 17, *E. poloni* being more abundant than *P. stella*.

Control of the earlier stages of the insect by spraying is impossible owing to the manner of feeding. Oviposition can be checked by the use of a repellent applied at the appearance of the first two leaves. Tar-water has been used in this way in Australia against *A. phaseoli*, Coq. (French bean fly). Such a spray must remain on the leaf until the danger period is passed and it must be applied uniformly to both surfaces of the leaves. It is doubtful whether such a method would prove economical. A poison-bait such as sweetened Paris green and lead arsenate on the leaves of young plants would probably kill many adult flies. The easiest and most economical remedial measure is undoubtedly by cultural methods. The immunity of certain varieties and the best time for planting susceptible varieties should be studied. If infestation by the larvae be so heavy that the young plants have no chance to survive, it is best to sacrifice the whole field, ploughing the plants under deeply before pupation has begun. Badly infested plants should be pulled up, the soil about the bases which contains the pupae being first loosened with a sharp pointed stick so that it will come away with the plant. Badly infested petioles should be pulled off and destroyed. Collection of the adults in nets helps to check the numbers. Thorough and frequent cultivation and ample moisture supply when the plants are young enables them to grow rapidly and resist attack. As the flies breed freely in self-sown beans, these should be destroyed.

Del Guercio (G.). **A Tortricid Moth injurious to the Chestnut Tree in Italy.**—*L'Agricultura Coloniale, Florence*, xii, no. 1, 1918, pp. 21–30, 8 figs. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 9, September 1918, p. 1127.)

The larval stages of *Cydia* (*Carpocapsa*) *splendana* are very injurious to chestnuts in the Apennines. The nuts fall prematurely and are found to be punctured by a round hole, hidden by a mass of excreta, which is the opening of the larval tunnel. From August to November the infestation increases and when the drying of the chestnuts by fire is begun in November many larvae leave the nuts after 24 to 36 hours exposure to the heat. When the nuts have been dried and freed from the pericarp, the worm-eaten ones should be separated from the sound

ones before grinding them to flour. Nuts that fall in August should be collected and burnt or buried deeply, or they may be thrown into stagnant water. The first chestnuts to fall should on no account be left lying on the ground.

JOLYET (A.). **The Use of Bats in the Control of Insects especially Tortricidae, injurious to Pine Woods.**—*Revue des Eaux et Forêts, Paris*, lvi, no. 6, 1st June 1918, pp. 121-216. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 9, September 1918, pp. 1123-1124.)

In view of the possibility of invasion of the damaged French forests by such pests as *Rhyacionia* (*Evetria*) *resinella*, *R.* (*E.*) *buoliana*, Schiff. (pine-shoot tortrix), and *R.* (*E.*) *turioniana*, Hb. (pine-bud tortrix), the author advises the breeding of bats or their encouragement and protection in or near pine woods. It is suggested that cots should be erected to serve as a refuge during the day and a shelter during the winter. The cot is made of a wooden box with double walls (leaving an air space of about 1 in.) in the form of a cube with side 3 feet 3 inches long. This is protected from rain by a double roof of planks covered with tarred paper and projecting beyond the sides. The space between box and roof should be filled with hay. On the side of the box facing east an opening 12 inches high and 8 inches wide should be cut, fitted with a sliding door that could be operated by a string. The box should be placed about 10 feet high on a wooden scaffold, and should be fitted with rods for perches. The choice of bats belonging to the genus *Vesperugo* is advocated, as these hibernate in barns, hollow trees, etc., rather than those that hibernate in caves and are more sensitive to cold. *V. noctula*, *V. serotinus* and *V. pipistrellus* are mentioned as particularly suitable species.

HENRY (G. M.). **Sweet Potato Weevil.** (*Cylas formicarius*).—*Trop. Agriculturist, Peradeniya*, li, no. 3, September 1918, p. 176, 1 plate.

Cylas formicarius (sweet potato weevil) is a destructive pest in Ceylon, where it attacks the thicker stems and the tubers of the sweet potato and lays its eggs in them. The complete life-cycle has not been worked out in Ceylon, but is known to be as short as 30 days in Florida and Queensland. Infestation is difficult to detect until it has become fully established and the tubers are full of larvae; great care should be taken in planting to use only sound setts. The thicker stems of vines should be discarded as being more likely to contain eggs or larvae. An infested field should be harvested as early as possible and utilised for home consumption. Any tubers unfit for use should at once be burnt. The neighbouring land, as well as the infested field, should be kept free from sweet potatoes for at least two years, but may be planted with any other crop.

BERGER (E. W.). **Directions for Building Fumigating Boxes and for Fumigating with Hydrocyanic-acid Gas.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, i, no. 2, January 1917, pp. 15-24, 2 plates, 1 fig. [Received 13th November 1918.]

In this paper full directions are given for constructing boxes for fumigating with hydrocyanic-acid gas.

To fumigate citrus trees, immature peach trees, roses, buds and scions in a fumigating box, with sodium cyanide, $\frac{1}{2}$ oz. per 100 cu. feet is required. In the case of dormant peach trees, or similar hardy deciduous trees such as apple, pear and plum, $\frac{3}{4}$ oz. sodium cyanide per 100 cu. feet box space is necessary.

The following tabulated formulae are given:—For *Citrus*, etc., $\frac{1}{2}$ oz. sodium cyanide (96–98 per cent. pure), $\frac{3}{4}$ oz. sulphuric acid (93 per cent. pure), $1\frac{1}{2}$ oz. water; for peach, etc., $\frac{3}{4}$ oz. sodium cyanide (96–98 per cent. pure), $1\frac{1}{8}$ oz. sulphuric acid (93 per cent. pure), $2\frac{1}{4}$ oz. water; for *Citrus*, etc., $\frac{3}{5}$ oz. potassium cyanide (95–96 per cent. pure), $\frac{3}{5}$ oz. sulphuric acid, $1\frac{4}{5}$ oz. water; for peach, etc., 1 oz. potassium cyanide, 1 oz. sulphuric acid, 3 oz. water. The time required for fumigation in each case is 30 minutes.

Annual Report 1915.—*Qtrly. Bull. Florida State Plant Board, Gainesville*, i, no. 3, April 1917, pp. 59–123. [Received 13th November 1918.]

The maintenance and improvement of the Port and Railway Inspection service are imperatively necessary if the following insect pests are to be permanently kept out of the State of Florida:—Morelos fruit worm and the pink boll-worm [*Pectinophora gossypiella*] both occurring in Mexico, avocado weevil [*Heilipus lauri*] from Central America, spiny citrus whitefly [*Aleurocanthus woglumi*] from Jamaica and the Bahamas, pineapple borer [*Metamasius ritchei*] from Jamaica, gipsy moth [*Porthetria dispar*] and brown-tail moth [*Nygmia phaeorrhoea*] from New England, and the Mediterranean fruit-fly [*Ceratitis capitata*] from many subtropical countries.

The Australian Coccinellid [*Novius cardinalis*] has been found fully as efficient in controlling the cottony cushion-scale [*Icerya purchasi*] in Florida as in California and other States. The control effected by it is in fact practically complete, so much so indeed that the beetles tend to disappear owing to their food supply being exhausted, and therefore need to be re-introduced from time to time. It has been found possible to keep living beetles and also supplies of *I. purchasi* in cold storage for a considerable time.

Experiments are being made to determine the best treatment for camphor trees infested with the camphor-thrips [*Cryptothrips floridensis*]. Treatment with a 2 per cent. oil emulsion, applied to the infested trees after they have been severely cut back, promises to be both an efficient and practical method for treating infested nursery stock.

Back (E. A.). **Florida and the Mediterranean Fruit Fly.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, i, no. 4, July 1917, pp. 159–171, 2 plates, 5 figs. [Received 13th November 1918.]

The possibility is discussed of the spread of *Ceratitis capitata* (Mediterranean fruit-fly) into the North American continent, at present the only large land area upon which it has not become established. The history of its spread in other parts of the world is given, together with known instances of artificial dissemination. While conditions in the past have not favoured the establishment of this pest in California and the Gulf Coast States, the opportunities for such a spread have

been greatly increased during the past few years, owing to its establishment in the Hawaiian Islands in 1910. Florida's greatest danger of infestation appears to be in the direction of the West Indies, since with the opening of the Panama Canal and the development of trade between North and South America, this is the region through which vessels pass from the now infested countries of Hawaii, Brazil, Australia, Argentina and the Mediterranean. Should this fly become established in Florida, it is likely to become a serious and ever-present pest, since climatic conditions are favourable to its increase; though, on the other hand, the dearth of native host-fruits would render a successful campaign for its control possible.

WILSON (C. E.). **Some Florida Scale-Insects.**—*Qtrly. Bull. Florida State Plant Board, Gainesville,* ii, no. 1, October 1917, pp. 2–65, 70 figs. [Received 13th November 1918.]

This paper, which aims at being, as far as possible, a practical bulletin for the use of field inspectors and planters, does not give a complete list of all the Florida species of Coccids, but serves as an introduction to such a work. The host-plants mentioned are divided into two groups, those found to be infested in Florida, and those which, serving as food-plants elsewhere, are liable to be attacked in Florida. The species, of which 79 are listed, are arranged in alphabetical order under their popular names.

BERGER (E. W.). **Control of Scale-Insects, or Coccidae, in Florida.**—*Qtrly. Bull. Florida State Plant Board, Gainesville* ii, no. 1, October 1917, pp. 66–81. [Received 13th November 1918.]

The ideal time to spray for armoured scales is while they are abundant in the first 3 weeks of their life, approximately during March and April, June and July, and September and October, though it may be advisable to spray without waiting for their appearance with the strongest insecticide usable at the time, repeating this, if necessary, 3 or 4 times, at intervals of 2 or 3 weeks. Most, if not all, of the armoured scales are more or less attacked by several Coccinellids and other predaceous beetles, or by a number of Hymenopterous parasites.

Soft scales are generally easily destroyed by spraying with oil emulsions or mixtures of soap and water. In Florida they are probably regularly parasitised and controlled by Hymenoptera, *Coccophagus lecanii*, Fitch, for example, very commonly infesting the soft brown scale [*Coccus hesperidum*, L.].

Several species are also largely controlled by the fungus, *Aschersonia*, *Coccus hesperidum*, L., and hemispherical scale [*Saissetia hemisphaerica*, Targ.] being infested with either *A. turbinata* or *A. cubensis*. The latter has recently been observed to eradicate almost completely a severe infestation of the tulip-tree scale (*Toumeyella liriodendri*, Gmel.), and more recently severely to infest the palm or tessellated scale [*Eucalymnatus tessellatus*, Sign.].

For cushiony scales, extra amounts of soap should be mixed with the oil sprays, and if soap alone is used, it should be at the strength of 15–18 lb. per 50 U.S. gals. water. Fortunately, spraying solutions are rarely needed against these scales, since they are controlled by parasites

and predaceous insects, the cottony cushion scale [*Icerya purchasi*, Mask.] being attacked by *Novius cardinalis* and the larvae of the moths, *Laetilia coccidivora* and *Pyroderces rileyi*, also by the Agromyzid fly, *Cryptochaetum monophlebi*, Skuse, introduced into California from Australia. The green shield-scale [*Pulvinaria psidii*, Mask.] is also attacked by the above-mentioned moth larvae, and by another Agromyzid, *Leucopis nigricornis*, Egger.

Mealy-bugs do not often become a pest in Florida, but colonies of the Sicilian mealy-bug parasite, *Parleptomastix abnormis*, from California have recently been received and colonised in different parts of Florida [see this *Review*, Ser. A, v, p. 285]. The Florida wax scale [*Ceroplastes floridensis*, Comst.] is frequently parasitised by the fungus, *Aschersonia turbinata*.

Fungus parasites of scale-insects are generally introduced into scale-infested trees by tying pieces of twig, bark, or other material having fungus upon it, on to the limbs where scales are most abundant in such a manner that rains will wash the spores down over the masses of scales, the period of summer rains being the proper time for this operation. Another method of introduction is by spraying a mixture of spores in water into the infested trees. The chief scale fungi are:—Red-headed scale fungus (*Sphaerostilbe coccophila*), which has been found destroying many species, including purple scale [*Lepidosaphes beckii*, Newm.], long scale [*L. gloveri*, Pack.], San José scale [*Aspidiotus perniciosus*, Comst.], oleander or chinaberry scale [*A. hederae*, Vall.], chaff scale [*Parlatoria pergandei*, Comst.], California red scale [*Chrysomphalus aurantii*, Mask.] and the latania scale [*Aspidiotus lataniae*, Sign.]; white-headed scale fungus (*Ophionectra coccicola*), which has much the same distribution and appears to be the earliest recorded scale-fungus in Florida, being the most efficient destroyer of *Lepidosaphes beckii*, *L. gloveri*, and *Parlatoria pergandei*; black scale fungus (*Myriangium duriaei*), widely distributed and occurring on the three last-mentioned scales and also on the citrus snow scale [*Chionaspis citri*]; pink scale fungus (*Microcera fujikuroi*), widely distributed in Florida and Japan, and particularly effective on Florida red scale [*Chrysomphalus aonidum*]; turbinate fungus (*Aschersonia turbinata*), which is the common parasite of the Florida wax scale [*Ceroplastes floridensis*, Comst.] and probably infests other so-called soft scales, though it has undoubtedly been mistaken for *A. cubensis*, which has been positively identified infecting *Toumeyella liriodendri*, Gmel., and *Eucalymnatus tessellatus*, Sign.

Some contact insecticides prepared according to Mr. Yothers' formulae are:—(1) Fish-oil soap 2 gals., mixed with water 1 gal., to which are added 3 gals. Diamond paraffin or other lubricating oil (24–28° Bé.), the mixture being stirred vigorously or pumped back into itself several times till emulsified; for spraying citrus trees, 1 gal. must be diluted with from 50–100 gals. water; for spraying in late autumn, winter, and early spring 1 part in 50 or 60 of water must be used; for dormant deciduous trees without foliage 1 part in 10 parts water may be used; (2) fish-oil soap 1 gal., water 1 gal., oil (as before) 2 gals., to be prepared and diluted as in (1); (3) fish-oil soap or laundry soap 2 lb., water (to make 4 U.S. gals. of stock solution) about $1\frac{3}{4}$ U.S. gals., oil (as before) 2 U.S. gals., the mixture to be heated to boiling point, stirred and diluted as in formula (1).

Other contact insecticides giving good results are: Proprietary miscible oils and emulsions; soaps; kerosene emulsion; kerosene-lime mixture, composed of kerosene (42° Bé.) 20 U.S. gals., unslaked lime 40 lb., water 200 U.S. gals.; lime-sulphur solution; and tobacco extract.

NEWELL (W.). **Sweet Potato Root Weevil.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, ii, no. 1, October 1917, pp. 81–100, 2 figs. [Received 13th November 1918.]

Cylas formicarius F. (sweet potato root-weevil) is a pest that for many years has severely injured, and in many cases totally destroyed, the sweet potato crop in certain parts of Florida. This paper gives a full account of its history, distribution, life-history, host-plants, and methods of dissemination, as well as natural and artificial remedial measures [see also this *Review*, Ser. A, i, p. 217; iii, p. 461; v, p. 313].

Experiments have been begun aiming at the complete eradication of this pest when occurring in isolated outbreaks. The method employed consists in: (1) spraying the entire field with kerosene to destroy any adult weevils; (2) cutting and burning all potato vines on a log fire; (3) carefully digging out and burning all tubers and as many roots as possible; (4) ploughing the field and picking and burning all pieces of sweet potato plant; (5) harrowing the field several times and repeating the picking out process; (6) partly burying in various parts of the field clean sweet potatoes to act as traps, visiting these daily to destroy the adult weevils, burning the traps each week to destroy any eggs deposited on them, and replacing them by fresh ones, this practice being continued for the rest of the season.

HOYT (A. S.). **The Avocado Weevil** (*Heilipus lauri*, **Boh.**)—*Qtrly. Bull. Florida State Plant Board, Gainesville*, ii, no. 2, January 1918, pp. 108–112, 3 figs. [Received 13th November 1918.]

The development of the avocado industry in California in the years 1912–1913 led to the issue of quarantine regulations both in that State and in Florida prohibiting the importation of avocado seeds from Mexico and Central America, since large quantities of seeds had to be destroyed or refused landing owing to the presence of *Heilipus lauri*, Boh. (avocado weevil), *Caulophilus latinasus*, Say (broad-nosed grain weevil), *Araecerus fasciculatus*, De G. (coffee-bean weevil) and a small Scolytid beetle.

In captivity the adult weevil will feed upon the fruit, leaves, stem and seeds, even attacking the hard surface of a thoroughly dry seed. It is practically impossible to detect the presence of the larva within the seed, and fumigation for 6 hours in an atmosphere saturated with carbon bisulphide fails to destroy it. Experimental fumigation in a partial vacuum has given very encouraging results, but the method has not yet been recommended as a means of modifying the avocado seed quarantine. Empowered to enforce the rules and regulations of the Federal Horticultural Board, it is now the duty of the port and railway inspectors of Florida and the quarantine officers of California to do their part in preventing this weevil from establishing itself in these States.

HUNTER (W. D.). **The Pink Bollworm Problem in the United States.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, ii, no. 3, April 1918, pp. 139–149, 5 figs. [Received 13th November 1918.]

The subject matter of this paper has recently been dealt with from another source [see this *Review*, Ser. A, vi, p. 543].

BERGER (E. W.). **Termite Injury to Sweet Potatoes.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, ii, no. 4, July 1918, pp. 190–191, 1 fig. [Received 13th November 1918.]

Among injuries most likely to be confused with those due to *Cylas formicarius*, F. (sweet potato weevil) are those caused by termites. The chief differences between these injuries are:—(1) Absence of larvae and pupae in the tunnels made by termites, though their presence is apparent when the tuber is weevil-infested; (2) absence of excreta when the injury is due to termites, but an abundance of this in the tunnels produced by the weevil; (3) the exit and entrance holes very apparent in the case of termites, though weevil-infested tubers may show little or no outward evidence of their internal condition; (4) tunnels made by termites have clean-cut outlines in marked contrast with those made by the weevil; (5) in growing plants, tunnelling larvae of the weevil may be found in the stems near the ground.

DOTEN (S. B.). **Department of Entomology.**—*Ann. Repts. Board of Control for Years ending 30th June 1915, 1916, 1917; Univ. Nevada Agric. Expt. Sta., Reno*, 1916, 1917, 1918; pp. 35–38, 45, 68–69, 2 figs. [Received 14th November 1918.]

Cutworms that have done considerable damage to lucerne in Nevada are *Euxoa ridingsiana* (desert cutworm) and *Lycophotia* (*Peridroma*) *margaritosa* (variegated cutworm). The former has been found feeding on the young shoots in spring, while the latter causes similar damage to the second crop, eating the buds and the green rind from the stems.

Though the destruction of cutworms by drowning is not easy, it has been effected where the check system of irrigation was used, and also where the land was sloping and it was possible to wash them from the furrows into a ditch by means of a heavy head of water. Cutworms may also be destroyed in immense numbers by pigs, ground squirrels, turkeys, chickens and blackbirds, and they are also attacked by several parasitic and predaceous insects.

From time to time, grasshoppers have done serious damage to second crops of lucerne, and recently an Aphid, *Macrosiphum creeli*, has been numerous enough at times to be destructive to this crop.

CUSHMAN (R. A.). **The Correct Names for some of our Common Ichneumonid Parasites.**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 1, January 1918, pp. 9–12. [Received 15th November 1918.]

Among the most important parasites of the codling moth [*Cydia pomonella*], tussock moth [*Hemerocampa*], tent caterpillar [*Malacosoma*] and many other insects of economic importance in North America are the Ichneumonids that have been known for many years under

the names, *Pimpla annulipes*, Brullé, *P. inquisitor*, Say, and *P. inquisitoriella*, D.-T. Careful study of specimens and literature however shows that these names as usually applied are erroneous, and the following synonymy must be employed:—*Pimplidea aequalis*, Prov. (*Pimpla annulipes*, auct., *nec* Brullé, *P. conquisitor* var. *rufuscula*, Davis); *Pimplidea tenuicornis*, Cress. (*Meniscus marginatus*, Prov., *M. ashmeadi*, Prov.), *M. marginatus* and *M. ashmeadi*, having been previously treated as synonyms of *P. annulipes*; *Epiurus inquisitoriella* D.-T., (*Pimpla* (*Iseropus*) *inquisitor*, Say); *Iseropus coelebs*, Walsh (*Ichneumon inquisitor* var. *a*, Say, *Bassus cylindricus*, Prov., *Pimpla* (*Itoplectis*) *orgyiae*, Ashm., *Pimpla bruneifrons*, Vier.).

GAHAN (A. B.). **Description of a New Hymenopterous Parasite (Braconidae).**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 1, January 1918, pp. 18–19. [Received 15th November 1918.]

Microbracon cephi, sp. n., here described, is an important parasite of the western grass-stem sawfly, *Cephus cinctus*. The type was reared from a larva of *C. cinctus* infesting stems of *Agropyron*, other specimens being from the same host in stems of *Elymus* and *Bromus* in North Dakota and in stems of *Elymus canadensis* in Manitoba.

GAHAN (A. B.). **Three New Chalcidoid Egg-Parasites.**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 2, February 1918, pp. 23–26. [Received 15th November 1918.]

The species dealt with in this paper are:—*Gonatocerus ornatus*, sp. n., *Polynema imitatrix*, sp. n., and *Abbella* (*Ittys*) *perditrix*, sp. n., all reared from eggs of the alfalfa hopper, *Stictocephala festina*, Say, in Arizona.

GREENE (C. T.). **Three New Species of Diptera.**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 4, April 1918, pp. 69–71. [Received 15th November 1918.]

One of the new flies described in this paper is a Chloropid, *Madiza conicola*, sp. n., the larva of which feeds in cones of *Abies concolor* in Oregon and California.

MCGREGOR (E. A.). **A New Host Plant of the Boll Weevil.**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 4, April 1918, pp. 78–79. [Received 15th November 1918.]

In November 1917, *Anthonomus grandis* var. *thurberiae* was found heavily infesting a wild littoral species of cotton, *Gossypium davidsoni*, in Mexico. This plant, which is a vigorous shrub of dense habit, growing on moist sand dunes almost at the ocean's edge, was in an advanced fruiting condition and the bolls were harbouring adult weevils in abundance. This shrub occurs extensively throughout the southern part of Lower California at elevations varying from sea level to 1,400 feet, and as far northward on the east shore of the Gulf of California as Guaymas.

ROHWER (S. A.). **New Sawflies of the Subfamily Diprioninae (Hym.).** —*Proc. Entom. Soc. Washington, D.C.*, **xx**, no. 4, April 1918, pp. 79–90. [Received 15th November 1918.]

This preliminary paper outlines the classification used in a revision of the species of the subfamily DIPRIONINAE.

Keys are given (1) to genera based on the adults, (2) to the subgenera of *Diprion*, Schrank, and *Neodiprion*, gen. n., and (3) to the species of *Zadiprion*, subgen. n.

The following new species are described :—*Augomonoctenus libocedri*, gen. et sp. n., reared from larvae feeding in the cones of *Libocedrus decurrens* in Oregon ; *Neodiprion* (*Zadiprion*) *vallicola*, from Mexico ; *Neodiprion dyari*, bred from larvae on *Pinus virginiana*, in Virginia ; *N. scutellatus* from Washington; *N. mundus* from California ; *N. virginiana* and *N. affinis*, reared from larvae on *Pinus virginiana* in West Virginia ; and *N. maura*, reared from larvae on Jack pine (*Pinus banksiana*) in Wisconsin.

CUSHMAN (R. A.). **A Convenient Method of Handling large Numbers of Individuals in Life-History Studies of Insects.**—*Proc. Entom. Soc. Washington, D.C.*, **xx**, no. 5, May 1918, pp. 112–114, 1 plate. [Received 15th November 1918.]

The method here outlined, which is not applicable to all sorts of insects, but is in fact probably limited in practice to externally feeding ones, consists in starting with an ovipositing female, or a large number of eggs or larvae in one cage. As changes to be recorded take place, those individuals that have undergone them are transferred to another cage, leaving the unchanged one in the original cage. The number of cages to be handled gradually increases, but never reaches the number that would be necessary in starting with the same number of individuals when kept isolated.

Each original cage is given a number or letter and each subsequent cage is represented by a decimal, the stage or instar in any cage being thus indicated by the number of decimals.

The paper concludes with a copy of a page from the author's note-book on the life-history of the currant sawfly, *Pteronus* (*Pteronidea*) *ribesii*, Scop., showing the method adopted.

BAKER (A. C.). **The Identity of *Aphis circezandis*, Fitch.**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 6. June 1918, pp. 130–131. [Received 15th November 1918.]

The identity of *Aphis circezandis*, Fitch, collected on *Gallium circaezans* in Salem is discussed, the conclusion being reached that this species is identical with *A. gossypii*, Glover.

GIBSON (A.). **Report on Insects for the Year ; Division no. 1, Ottawa District.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto*, 1918, pp. 18–20. [Received 16th November 1918.]

The injurious insects reported during the year included *Diabrotica vittata*, F. (striped cucumber beetle), which was abundant on cucumbers and squashes during the early summer, and was controlled by a

drenching spray of ordinary poisoned Bordeaux mixture; *Macrobasis unicolor*, Kby. (ash-gray blister beetle), injurious to potatoes in the first half of July; *Hylemyia antiqua*, Mg. (imported onion maggot); *Phorbia brassicae*, Bch. (cabbage root maggot); *Leptinotarsa decemlineata*, Say (Colorado potato beetle); *Macrosiphum solanifolii*, Ashm. (potato aphis), which was present in large colonies and was successfully controlled in Ottawa by spraying with Blackleaf 40; *Epitrix cucumeris*, Harr. (potato flea-beetle), which attacked potatoes in early July and also tomatoes and cucumbers; *Ceramica picta*, Harr. (zebra caterpillar), present in large numbers in September on turnip and cabbage; *Diacrisia virginica* , F. (yellow woolly-bear caterpillar) and *Estigmene acraea*, Dru. (salt marsh caterpillar), abundant in Eastern Canada. In the Ottawa district in August and September the foliage of low-growing plants was much injured, and cabbages, turnips and other vegetables were eaten. The outbreak has been the worst for many years. Elaterids (wireworms) damaged potato tubers; *Lachnosterna* spp. (white grubs) caused but little injury, though there were important flights of *L. dubia* during the latter half of May and injury by the second-year larvae is anticipated in 1918. *Conocephalus fasciatus*, De G. (slender meadow grasshopper) was very destructive in some localities to maize. *Psila rosae*, F. (carrot rust-fly) was injurious in some gardens in the Ottawa district; *Phyllotreta armoraciae* (horse-radish flea-beetle) occurred in large numbers in one or two localities, the leaves of horse-radish being riddled by the beetles.

Fruit and forest trees were attacked by *Schizura concinna*, A. & S. (red-humped apple-tree caterpillar), which was unusually abundant in some orchards; *Eriocampoides limacina*, Retz. (cherry slug); *Eucosma (Tmetocera) ocellana*, Schiff. (eye-spotted bud-moth) causing important injury in some unsprayed orchards. *Halisidota caryae*, Harr. (hickory tussock caterpillar), *H. maculata*, Harr. (spotted tussock caterpillar) and *H. tessellaris*, A. & S. (checkered tussock caterpillar) were all remarkably abundant on apple, elm, basswood, maple, birch and other trees.

In gardens and greenhouses *Poecilocapsus lineatus*, F., (four-lined leaf-bug) damaged the foliage of asters, dahlias, zinnias, etc.; *Papaipema cataphracta*, Grt. (burdock borer) destroyed delphiniums, dahlias and other plants with succulent stems; *Pyrrhia umbra*, Hfn., destroyed rose-buds at Ottawa, young larvae being found on 21st July. In the control of soft scale-insects on ferns a successful spray was made with 3 oz. Sunlight soap to one U.S. gal. water, applied heavily several times at one week's interval.

Cosens (A.). **Report on Insects for the Year; Division no. 3, Toronto District.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto*, 1918, pp. 20–22. [Received 16th November 1918.]

In the Toronto district the conditions were extremely favourable to Lepidoptera in 1917. *Hemerocampa leucostigma*, S. & A. (white-marked tussock moth) was abundant throughout the city, defoliating many of the shade-trees, particularly horse-chestnuts, and *Acronycta americana* was plentiful on elms. The larvae of *Diacrisia virginica*, F., which are usually seen only in the autumn, were abundant in gardens

throughout the summer, apparently preferring virginia creeper but feeding also on grape-vines, honeysuckle, lettuce and other plants. *Isa isabella*, S. & A., was observed in normal numbers only, though usually the more abundant of the two species. *Pieris (Pontia) rapae*, L., was an unusually abundant pest, especially during August. *Danais (Anosia) plexippus* (monarch butterfly) was also present in large numbers. *Tinea pellionella*, L. (clothes-moth) and the large Saturniids, *Samia cecropia* and *Telea polyphemus*, were more than usually numerous.

Morris (F. J. A.). **Report on Insects for the Year; Division no. 5, Peterborough District.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto*, 1918, pp. 22–28. [Received 16th November 1918.]

This paper is a continuation of the notes on Longicorn and other beetles in the report for the previous year [see this *Review*, Ser. A, v, p. 548].

Noble (J. W.). **Report on Insects for the Year; Division no. 6, Essex District.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto* 1918, pp. 28–30. [Received 16th November 1918.]

A number of the usual pests of fruits and vegetables are recorded; no infestation of outstanding importance occurred during the year.

Ross (W. A.). **Report on Insects for the Year; Division no. 7, Niagara District.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto*, 1918, pp. 29–30. [Received 16th November 1918.]

Insects recorded as injurious to field crops included *Contarinia (Itonida) tritici* (wheat midge), which was abundant in several localities about mid-July, about 35 per cent. of the grain being shrivelled as a result of the attack in the worst infested fields. *Macrosiphum granarium* (grain aphis) was abundant on oats in certain areas. *Haplothrips statices*, Hal., and *Cydia (Laspeyresia) interstinctana* were numerous on alsike and red clover; *Perrisia (Dasyneura) leguminicola* (clover seed midge) destroyed as much as 44 per cent. of one crop examined; *Pegomyia fusciceps* (seed-corn maggot) was very destructive to beans in Welland County. Fruit pests that were numerous and injurious included *Hemerocampa leucostigma* (white-marked tussock-moth) on apples, *Psylla pyricola* (pear psylla) and *Rhagoletis pomonella* (apple maggot). Miscellaneous insects included *Chermes abietis* (spruce gall-louse) on Norway spruce, and *C. pinicorticis* on young white pines.

Gibson (A.). **Further Notes on the Imported Onion Maggot (*Hylemyia antiqua*, Mg.) and its Control.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto*, 1918, pp. 30–33. [Received 16th November 1918.]

The experiments described in this paper, which supplement a previous bulletin on *Hylemyia antiqua*, Mg. [see this *Review*, Ser. A, iv, p. 347], have already been recorded from another source [see this *Review*, Ser. A, vi, p. 122]. Observations during the year have confirmed the supposition that this fly hibernates in the pupal stage in Canada.

Maheux (G.). The Entomological Service of Quebec.—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto,* 1918, pp. 33–36. [Received 16th November 1918.]

The author points out that while America is troubled by a far greater number of insect pests than the Old World, the American governments are always creating and organising various services for the aid of the public and the agricultural community, while in Europe private initiative is generally left to its own resources in dealing with entomological problems. The history of the entomological service, which has already created numerous bureaus in North America, is briefly reviewed. The work undertaken in the Province of Quebec is outlined, and includes inspections, propaganda, collections and general work. It is suggested that a bye-law obliging every grower to spray his crops would ensure better results. An Entomological Society is now being organised in Quebec.

Caesar (L.). Some Important Insects of the Season.—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto,* 1918, pp. 36–44. [Received 16th November 1918.]

Fenusa (*Metallus*) *bethunei* (blackberry leaf-miner), which is closely allied to *F.* (*M.*) *rubi*, was so numerous during 1917 that whole fields of blackberries had a blighted appearance owing to the mining of the leaves. There are two generations of this sawfly in a year. Adults begin to appear about 1st July, eggs being laid in the tissues of the leaves, chiefly near the midrib. The larvae mine the leaves, and about the time the fruit is ripe they are full-grown and have begun to leave the mines and enter the soil, where they pupate an inch or two below the surface. Adults of the second generation begin to emerge after two weeks and by 21st September are very abundant. Larvae of the second generation hibernate in earthern cocoons in the soil. The chief damage done is to weaken the plants and lessen the following year's crop. The best method of control as yet known is the poisoning of the adults with lead arsenate applied so heavily that it will remain on the foliage a month or more. This should be done just before blossoming or just after most of the blossoms are off.

Ceramica picta (zebra caterpillar), which is not generally very numerous, has been abundant in many counties west of Toronto, and has stripped many turnip fields of foliage, attacking also cabbage and several other plants. The only remedial measure that has been found satisfactory is dusting with Paris green mixed with 20 times or more its bulk of air-slaked or hydrated lime, or land plaster [gypsum]. *Cydia* (*Carpocapsa*) *pomonella* caused an unusual amount of side injury to apples in the early part of the fruit season. A poison-spray thoroughly applied three weeks after the blossoms fell gave good results. Other moths recorded include *Alypia octomaculata* (eight-spotted forester), abundant on grape foliage near Toronto, and *Datana integerrima*, which defoliated walnuts in Essex and Kent.

Felt (E. P.). The Apple and Thorn Skeletonizer (*Hemerophila pariana*, Clerck).—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto,* 1918, pp. 44–47. [Received 16th November 1918.]

Hemerophila pariana, Clerck (apple and thorn skeletoniser), though a minor pest in Europe, is already sufficiently established in some

counties of Ontario to cause the defoliation of entire orchards, and conditions favour its further increase. A description of the various stages is given. Both adults and pupae apparently hibernate, the former in such shelters as thatch, and the latter in cocoons attached to the leaves. In England two and probably three generations in a year are recorded and, while there is considerable variation in development towards the end of the season in America, the life-history is probably similar to that in Europe. Eggs are deposited probably when the leaves are partly developed, the caterpillars feeding on the upper leaf-surface, skeletonising the leaves while working under a slight web, the margins of the leaves sometimes being webbed down. This injury probably continues for a month or six weeks. While apple is apparently the preferred food, pear, hawthorn, mountain ash, birch and possibly willow are attacked. It is hoped that some parasites of *H. pariana* have become established with the host; a few individuals of *Diodes obliteratus*, Cress., have already been reared from American material. Thorough and timely spraying with lead arsenate on all trees upon which the pest can subsist in infested areas would undoubtedly prevent material damage from the insect.

Ross (W. A.). **The Black Cherry Aphis.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto,* 1918, pp. 59–68. [Received 16th November 1918.].

This paper gives an account of *Myzus cerasi*, F. (black cherry aphis), studied in the Niagara district, where from 6 to 14 generations occur annually. The information amplifies that already given elsewhere [see this *Review*, Ser. A, vi, pp. 103 and 121].

Insect enemies of *M. cerasi* include the Coccinellids, *Adalia bipunctata*, L., *Coccinella novemnotata*, Hbst., *C. transversoguttata*, F., *C. trifasciata*, L., *C. sanguinea*, L., *Anatis quinquedecimpunctata*, Oliv., *Hippodamia tredecimpunctata*, L., and *Scymnus collaris*; the Syrphids, *Syrphus americanus*, Wied., *S. ribesii*, L., and *Allograpta obliqua*, Say; the Cecidomyiid, *Aphidoletes meridionalis*, Felt; *Chrysopa* sp. and an undetermined Acarid. Weather is one of the greatest factors influencing the numbers of *M. cerasi*; heavy showers wash many Aphids from the plants, and droughts, early frosts and wind storms all destroy large numbers.

Caesar (L.). **A Further Report on the Value of Dusting *versus* Spraying to control Fruit Tree Insects and Fungus Diseases.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto,* 1918, pp. 79–85. [Received 16th November 1918.]

A series of experiments is here recorded similar to those carried out in the previous year with dust sprays as compared with liquids [see this *Review*, Ser. A, v, p. 549]. As regards cost, dust is considered on the whole cheaper if carefully used. Various tests on apple trees are described, the foliage on all dusted trees being nearly perfect, though that on sprayed trees was almost equally good. As regards the control of codling moth [*Cydia pomonella*], there was little or no difference in the efficacy of the two methods. Trees dusted with sodium sulphide mixed with talc for the control of San José scale

[*Aspidiotus perniciosus*] were entirely cleared of that pest. The author still advocates the use of liquid sprays in apple orchards until improved dust substitutes and machinery are available and until further successful tests have been made. The value of dusting as regards brown rot in sweet cherries and plums is also discussed.

LOCHHEAD (W.). **New Notes on the Ecology of Insects.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto*, 1918, pp. 85-91. [Received 16th November 1918.]

The aspects of insect ecology touched upon in this paper include the inter-relations between insects and plants and the adaptations of each to the other, the carriage or encouragement of plant diseases by insects, the influence of birds on insect increase, and the behaviour of insects to such stimuli as light, heat, moisture, chemical contact, wind, etc.

BRITTAIN (W. H.). **Notes on Two unusual Garden Pests in Nova Scotia.**—*48th Ann. Rept. Entom. Soc. Ontario for 1917, Toronto*, 1918, pp. 94–99, 3 plates.

The particulars of the habits of *Gortyna micacea*, Esp. (potato stem borer) and *Ceramica picta*, Harr. (zebra caterpillar), given in this paper have already been recorded from another source [see this *Review*, Ser. A, vi, p. 241].

VETH (H. J.) & VAN RIJN (W.). **Eenige Mededeelingen over de *Lasioderma*-Plaag en hare Bestrijding.** [Some Communications on *Lasioderma* and Methods for combating this Pest.]—*Besoekisch Proefstation, Djember, Java*, 1915, 48 pp. [Received 11th October 1918.]

This is a reprint of a report on investigations conducted in 1910–1911. The authors then identified *Lasioderma serricorne* as the tobacco pest concerned and established the fact that infestation occurs before the tobacco is shipped from the Dutch East Indies, where the most scrupulous cleanliness is imperative in the packing sheds. The life-cycle of *L. serricorne* was found to require 80 days under average conditions of moisture and a temperature such as 30° C. (85° F.). Temperatures up to 50° C. (122° F.) in the hold of a ship do not hinder development, as this beetle can live at temperatures up to 55° - 60° C. (131°–140° F.). At the summer temperatures obtaining in Holland development is slow and a slight decrease gives rise to a latent state and, finally, death. Though tobacco is not damaged by contact with the fumes or liquid of carbon bisulphide, all stages of *L. serricorne* are killed by direct exposure for 24 hours in an air-tight container to the fumes of 60 c.c. per cubic metre of space. If the insects are within bundles of tobacco the quantity of carbon bisulphide must be increased to 180 c.c. These quantities are efficacious at 45°–55° F. (8°–12° C.), and at the temperatures obtaining in the Dutch East Indies they must be increased 50 per cent. Treated tobacco must be well aired afterwards.

In a supplement to their original report, the authors confirm the efficacy of carbon bisulphide, used under the above conditions, in killing

the eggs of *L. serricorne*. During the six-week voyage to Europe there is no danger of clean bales being damaged by infested ones stowed alongside them. Nor are clean bales infested by means of adult beetles flying about the hold, as they are unable to penetrate the matting with which the bales are covered.

Other supplements to this report comprise reprints of papers on this beetle and *L. laeve*, Illig., infesting cigars in Holland by J. C. Koningsberger, J. Ritsema Bos and L. P. De Bussy [see this *Review*, Ser. A, v, pp. 417 & 583].

ROEPKE (W.). **De Tabaksmier** (*Solenopsis geminata*, **F.**). [The Tobacco Ant, *S. geminata*, F.].—*Teysmannia, Batavia*, iii, 1918, pp. 192–200, 6 plates.

According to Koningsberger and following him, Sorauer, *Plagiolepis longipes* (gramang ant) is a species that carries off tobacco seed. It is here pointed out that *P. longipes* was not represented by even a single specimen in two large batches of ants collected on various tobacco estates at Klaten, Java. *P. longipes* is a Camponotine with habits very dissimilar to those of the true robber-ants, which all belong to the MYRMICINAE. In the first batch, which apparently included all ants found on tobacco seed-beds specially prepared as traps, ants other than seed-robbers were represented. The second batch was collected from ordinary seed-beds and corresponds to normal conditions. Both contained numerous individuals of *Solenopsis geminata*, F. (fire ant), which is probably the species concerned, at least in the Klaten district and probably in other parts of Java too. It also carries away the seeds of *Ocimum basilicum*. A description is given of all its stages together with a brief note on its life-history. As it is a ground inhabiting species, remedial measures are not easily applied. In the Klaten district the seed-beds are isolated by channels of running water. If this method cannot be used, it is advisable to spray the beds with petroleum-soap emulsion.

ROEPKE (W.). *Sideridis* (*Leucania, Cirphis*) *unipuncta*, **Haw., schadelijk voor het Rijstgewas.** [*Cirphis unipuncta* injurious to Rice Plants.]—*Teysmannia, Batavia*, v, 1918, pp. 270–275, 1 plate.

At the end of March 1918 caterpillars and pupae of *Cirphis unipuncta*, Haw., were received from the Buitenzorg district where this species was injuring rice. Specimens of this moth that were obtained in the past from Java were formerly recorded under the name *Leucania extranea*, Gn., which is a synonym of this species. The caterpillars are found in paddy-fields from which the water has been drained, but they are more abundant in fields ready for cutting and somewhat dry and almost absent in fields where the ground is sodden. Feeding is confined to the leaves, but this injury is unimportant. The real damage, estimated at 18 per cent. of the crop, is due to the caterpillars' habit of cutting off portions of the ripe or nearly ripe ears, and in some cases the ground is covered with these. Effective remedial measures include the wetting of fields nearly ready for the harvest either by flooding once or twice or by preventing the out-flow of rain-water,

and the ploughing and flooding of infested fields immediately after the harvest. A brief description is given of the life-history and various stages of this moth, which is universal in Java, where it also infests sugar-cane.

BERNARD (C.). **Verschillende Aanteekeningen over *Helopeltis*.** [Various Notes on *Helopeltis*.]—*Meded. Proefstation voor Thee, Buitenzorg*, lix, 1918, pp. 1–20, 1 plate.

The Tea Experiment Station at Buitenzorg is continuing investigations on *Helopeltis*, the work being based on Leefmans' results [see this *Review*, Ser. A, v, pp. 131 and 413]. It has been estimated that on an estate of about 1,900 acres the average annual loss (crop damage and expenses of remedial measures) may amount to £2,000, while the total annual loss in the Dutch East Indies is estimated at 11,000,000 lb. of tea of a value of £200,000. The Dutch planters are warned against a too confident acceptance of methods employed in British India, for the conditions in Assam, where all estates prune at the same time and insect pests disappear during the winter, cannot be compared with those in Java. Leefmans has recorded that some Leguminosae are attacked by *Helopeltis*, and further experiments enable the author to state that neither *Sesbania aegyptiaca* nor *Acacia decurrens* is attacked, so that they are useful green manure plants for infested districts. A case is recorded of injury by *Helopeltis* to a Java-coffee plant among severely infested tea. Several Capsids, as yet unidentified, were collected. It is confirmed that *H. cuneatus*, Dist., confines itself to a small number of Araceae. Some anatomical details of this species are described and figured.

Writing from Sumatra, Leefmans states that *H. theivora*, Waterh., occurs there on *Gardenia florida*, *Psidium guajava*, and other plants. On a plant called "Djaran" the same observer has also found *Pachypeltis vittiscutus*, Berg., which in Java severely injures cinchona and also occurs on tea.

BERNARD (C.) & GIANETTI (E.). **Het Vangen van *Helopeltis* door Middel van "Tanks" op de Onderneming Goenoeng Mas.** [The Capture of *Helopeltis* on the Goenoeng Mas Estate by Means of "Tanks."]—*Meded. Proefstation voor Thee, Buitenzorg*, lix, 1918, pp. 23–36, 3 plates.

It is customary in Java to employ women to catch *Helopeltis*, but they tend to collect the larvae in preference to the more active adults and are not always available. In an attempt to employ male workers without increasing the cost the following method was evolved:—A tent or cover made of white cotton material stretched on a light wooden or bamboo frame is carried by a coolie and placed over the tea bushes which are disturbed, thus causing the Capsids to fly up on to the white walls and roof where they are easily seen and caught. The framework has an outline similar to that of a house and is open at the bottom, the sides of which measure about 7 foot square. The cross-bars which hold the sides together enable the cover to be easily carried by the worker standing under and in it. From their slow methodical progress through the plantations, the author calls these

apparatuses "tanks." It has been found that the best total result is attained if the catchers follow the "tanks" over the ground, this accounting for the larvae, while the "tanks" deal with the adults.

von und zu Egloffstein (Frh. [Baron] H.A.C.F.E.). *Helopeltis*-**Bestrijding op de Onderneming Tjikopo-Zuid.** [Anti-*Helopeltis* Work on the Tjikopo South Estate.]—*Meded. Proefstation voor Thee, Buitenzorg,* lix, 1918, pp. 39–50.

In 1916 about 7 million *Helopeltis* were captured on this estate, the monthly figure varying from 933,552 in March to 328,036 in August. The variation depends partly on the number of workers (mostly children) available, labour at some seasons, such as when the rice crop is being harvested, being very scarce. In any case direct measures are inadequate and indirect ones must be resorted to. At Tjikopo the plantation was separated from the uncultivated land by a cleared belt about 1 yard in width. Many of the wild trees and bushes were found to harbour *Helopeltis*. The belt was widened to about 9 yards, and after an increased infestation of brief duration the tea bushes became much more free from the pest. Lamtoro [*Leucaena glauca*] seems to be beneficial to tea among which it is planted, but it was observed that in places where *Albizzia* was grown as a green manure *Helopeltis* occurred in great abundance. The very best remedy against *Helopeltis* is a dry East Monsoon [dry season] and the wet weather in 1915–1916 was the chief factor in the subsequent increase of infestation.

Froggatt (W. W.). **The Apple-leaf Jassid** (*Empoasca australis*).—*Agric. Gaz. N. S. W., Sydney,* xxix, no. 8, August 1918, pp. 568–571, 2 plates. [Received 18th November 1918.]

Attention is called to recent abundance on apple-trees in Australia of *Empoasca australis*, sp. n., which is closely related to, if not identical with, *E. mali*, but differs somewhat in colour and in the manner of injury. A description of this Australian species is given. The actual damage to the apple crop caused by these Jassids at present is not very serious, but in the middle of April they were very numerous and active, and if they were to appear early in the season, they might cause all the foliage to fall. It is considered advisable to clear up and dig into the soil all fallen leaves and weeds in which eggs might be deposited or where nymphs or adults might be sheltering in all infested orchards. As the eggs are laid under the bark in the young wood the best time to spray would be early summer before the first generations have had time to develop and deposit more eggs. Kerosene emulsion or tobacco and soap wash should be effective contact poisons.

Froggatt (W. W.). **Experimental Work with Fruit-flies.**—*Agric. Gaz. N. S. W., Sydney,* xxix, no. 8, August 1918, pp. 579–580. [Received 18th November 1918.]

The question of dealing with the fruit-flies, *Dacus ferrugineus* (*tryoni*) and *Ceratitis capitata*, otherwise than by the systematic destruction

of all windfalls and infested fruit, has been receiving a good deal of attention in New South Wales and is discussed in this paper. The breeding of the parasite *Opius tryoni* does not promise any measure of success, for while it freely attacks fruit-fly maggots on wild fruits, it is unable to reach those in the soft tissue of the succulent cultivated fruits. The various devices for destroying fruit-flies by poison-baits or sprays are reviewed. The results of tests with these indicate that fruit-flies can undoubtedly be trapped and poisoned with arsenical preparations. Many observers are of the opinion that no special form of trap is required, but that any shallow, clean, bright tin, if properly baited, will catch the flies. While traps and sprays are good additional precautions in badly-infested orchards, none of the existing regulations should be relaxed regarding the regular destruction of all fallen and infested fruit. The question arises whether it is more economical to collect and destroy infested fruit or to re-bait hundreds of traps every week and spray the trees after every rainstorm for six months of the year.

FULLAWAY (D.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xv, nos. 9–10, September-October 1918, pp. 381–382, & 408–409.

During July and August the insectary handled 47,400 pupae of the melon fly [*Dacus cucurbitae*] from which were bred 7,798 individuals of *Opius fletcheri.* The parasites distributed were:—*Opius humilis,* 395; *O. fletcheri,* 7,280; *Diachasma tryoni,* 1,875; *Spalangia cameroni,* 4,250; *Tetrastichus giffardianus,* 300; *Galesus silvestrii,* 300; *Pachycrepoideus dubius,* 900; and *Paranagrus osborni,* 56,800.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu,* xv, nos. 9–10, September-October 1918, pp. 383–384 & 409–411.

During July a case of orchids from Manila was fumigated with hydrocyanic acid gas owing to the presence of ants in the packing. Cases of banana sprouts and of yams from Manila were found infested with termites. The entire shipment was destroyed by burning, as this termite will probably prove to be the same species as that which is at present seriously damaging the docks and buildings throughout the city.

During August cases of Bartlett pears from the mainland were found infested with codling moth [*Cydia pomonella*], Otaheite orange trees from Pennsylvania with scale-insects, and pineapple plants from Florida with *Stigmaea floridanus* (Florida pineapple mite).

MALLOCH (J. R.). **The North American Species of the Genus *Tiphia* (Hymenoptera, Aculeata) in the Collection of the Illinois State Natural History Survey.**—*Illinois State Nat. Hist. Survey, Urbana,* Bull. xiii, no. 1, September 1918, 24 pp., 1 plate.

A revision of the genus *Tiphia* was found necessary as a result of a study of those species that are parasitic upon *Lachnosterna* (*Phyllophaga*) (white grubs). A key is given to the species contained in it, with descriptions of several new ones.

Davis (J. J.). **Co-operation among Agricultural Workers.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, pp. 406–410.

The author emphasises the need for workers in all branches of agriculture to keep in close touch with one another, and for the maintenance of a free exchange of ideas and plans between agronomists, entomologists, plant pathologists, chemists, foresters, animal husbandmen, meteorologists and others. He cites the familiar instances of the value of such co-operation in the investigations on the Hessian fly [*Mayetiola destructor*] and white grubs (*Lachnosterna*).

Back (E. A.). *Clytus devastator*, **a new Pest of the Florida Orange.** —*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, pp. 411–414, 1 plate.

The Cerambycid borer, *Clytus devastator*, was first described as a serious pest of *Citrus* in Cuba in 1836, and has since been recorded on the coasts of Florida. It has been reared from Cuban mahogany, pomegranate (*Punica granatum*), and orange (*Citrus*), and is reported to have as its preferred host the common mangrove (*Rhizophora mangle*). Apart from the original statement that it was a serious pest of *Citrus* in Cuba, it had not been reared from *Citrus* until it was found damaging orange trees on Perico Island, Florida, in the spring of 1910. The damage done by it closely resembles that due to *Cyllene robiniae* (black locust borer).

The larvae, when young, feed upon the inner bark and sapwood, and later bore into the harder and older wood, not only of various parts of the trunk, but also of the bases of the larger branches, and of the roots, both large and small. The mature larva has the habit, similar to that of *Saperda candida* (round-headed apple-tree borer), of eating its way to the surface, after which it retreats a short distance from the bark to pupate. The adult, on emergence, gnaws a hole about ⅜ to ½ inch in diameter in the bark and escapes.

With the extension of the citrus industry into more tropical portions of the State, this beetle may assume an important rôle as a pest of *Citrus*.

Flint (W. P.). **Insect Enemies of the Chinch-bug.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, pp. 415–419.

Very little study had been given to the predaceous or parasitic insect enemies of the chinch-bug [*Blissus leucopterus*] up to the time of the discovery of its egg-parasite, *Eumicrosoma benefica*, Gahan, in 1913. Among its earliest recorded enemies are a Coccinellid, *Hippodamia maculata*; a lace-wing, *Chrysopa illinoiensis*; bugs: *Triphleps insidiosus*, *Milyas cinctus*, and *Nysius angustatus* (false chinch-bug); ground beetles: *Agonoderus pallipes*, *Harpalus compar*, *Euarthrus sodalis*, and *Anisodactylus harpaloides*; and ants: *Solenopsis molesta* and *Monomorium minimum*, which carry off the eggs and dead adults.

During the outbreak in Illinois in 1909–1915, experiments were made with its commonest predaceous enemies, including:—*Chrysopa oculata* and *C. rufilabris*, the larvae of which were abundant in all fields of grain infested by the chinch-bug, and in the laboratory

devoured from 4 to 6 first and second instar chinch-bugs a day; *Reduviolus ferus* (damsel bug), the nymphs and adults of which feed on chinch-bugs, preferably nymphs in the third or fourth instar, two a day being eaten on an average; *Blechrus glabratus*, a small active beetle found in all grain fields after the middle of June, which feeds only on chinch-bugs in the first and second instars, 88 being eaten by one beetle in 26 days; a Nabid bug, *Pagasa fusca*, which seems to prefer the later stages and has been several times seen in the field feeding upon adults, one or two a day being devoured by specimens in the insectary; an Anthocorid bug, *Triphleps insidiosus*, which is one of the most efficient enemies of the second brood during the hatching period, being found in abundance during late July, August and September feeding on first and second instar chinch-bugs; a ground beetle, *Casnonia pennsylvanica*, which insectary experiments have shown to be of not much importance; another ground beetle, *Agonoderus pallipes*, which is very common in all grain fields in central and southern Illinois, but eats only dead chinch-bugs; and Coccinellid larvae, which are frequently seen to feed upon chinch-bugs in the field, but which in the laboratory gave no definite results.

A count of the number of predatory insects occurring in one square yard of a stubble field in July, showed on an average enough to eat eleven chinch-bugs per day per square yard, or about 2,000,000 per day for a 40-acre field. It seems probable from the abundance of these insects in the fields, and the numbers of chinch-bugs known to be eaten by them, that when, after a period of abundance, the chinch-bug increase is checked by adverse weather conditions, these predatory species, together with the egg-parasites, may keep it from causing damage for a number of years. *Reduviolus ferus* and *Pagasa fusca* were unusually abundant in infested fields during the summer of 1918.

PETTEY (F. W.). **A New Species of *Sciara* bred from Red Clover Crowns.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, p. 420, 1 plate, 1 fig.

Sciara trifolii, sp. n., reared in October from crowns of red clover in Idaho and closely related to *S. pauciseta*, Felt, is described.

BURRILL (A. C.). **New Economic Pests of Red Clover.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, pp. 421–424.

The third successive epidemic of the clover aphis (*Aphis bakeri*, Cowen) in Idaho, in 1916, considerably reduced the seed yield in red clover, and also in white and alsike clovers, in some cases by as much as 50 per cent. The 1917 crop seems to have been saved from excessive damage by great cold in January following on unusual numbers of Aphid enemies. When the clover heads are very sticky from the presence of Aphids, preliminary thorough drying is necessary before the seed can be threshed, and usually the heat caused by threshing melts the crystallised honeydew, so that whole sacks may cake nearly solid.

The enemies of this Aphid are very numerous, but seem unable to check its increase till the third or fourth week in August, by which time crop damage is almost complete. Larval Coccinellids in the

fields in August were bred out and proved to be mostly *Hippodamia quinquesignata*, Kirby, *H. convergens*, Guér., *H. lecontei*, Muls., and *Coccinella trifasciata*, L., but neither in this stage nor as adults do they seem to be able to penetrate to all parts of the clover head so as to destroy every Aphid, of which as many as 300 may be present on a single head.

The most abundant Syrphid flies have been reared and await determination. More numerous than these was a Hymenopterous parasite (*Aphelinus lapisligni*, How.), the parasitised Aphids, however, appearing more often in the lower leaf-petiole tracts sheathing the stem than in the head, pointing to an early attack of the parasites before the clover heads form. The nymphs of an Anthocorid bug, *Triphleps tristicolor*, White, are quite as numerous in some fields and more rapidly and persistently penetrate all parts of the clover bloom and stem than all other Aphid enemies combined.

Preliminary tests with orchard sprayers driven through the fields have shown that a majority of the Aphids may be destroyed with nicotine sulphate and soap at the usual strengths. Adults of *Hippodamia convergens* confined in small capsules of sprayed leaves, however, die from its effects. Sodium arsenite sprayed in lucerne and clover fields killed 99 per cent. of the grasshoppers, and the addition of nicotine for Aphids did not increase the scorching effects.

The part played by *Haplothrips statices*, Hal. (*Phloeothrips niger*, Osb.) (red or black thrips) in damaging clover and lucerne seed is not yet understood.

The most common mite on red clover crowns is *Rhizoglyphus rhizophagus*, Banks. Red clover roots received for examination proved to be infested with *R. rhizophagus*, a new mite, *Hologamasus inarmatus*, Ew., and *Sciara trifolii*, Pett., of which four broods were bred in the laboratory between October and February.

In spraying with nicotine and soap for bean thrips (*Heliothrips fasciatus*, Perg.) at the usual strength and with an orchard power sprayer, it was found that a large part of the infestation had not been reached by the spray. This was found to be due to a concurrent attack of *Tetranychus telarius*, L. (red spider), the leaves being so webbed together as to protect large numbers of thrips from being wetted.

O'Gara (P. J.). **Notes on a new Mite attacking Valley Cottonwood.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, p. 430, 1 plate.

The mite here dealt with is a new species of *Eriophyes* infesting *Populus wislizeni* in Texas. The type of injury caused by it is also new, and results in some of the leaf laminae becoming very much dwarfed and cut resembling a dense compound inflorescence.

Becker (G. G.). ***Lopidea media*, a persistent Pest of *Phlox*.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, p. 431.

Phlox plants in certain gardens of Fayetteville, Arkansas, have been infested for a number of years with a Capsid, *Lopidea media*. This bug appears every year in the same gardens, causing the tender

tips and leaves of infested plants to curl and turn yellow. In 1917 adults of the first generation were found by 5th May, though most of the Capsids were still in the nymphal stages. There are apparently at least three generations a year in Arkansas.

Van Dyke (E. C.). **A Second Food Plant for the Cherry Leaf-beetle.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, p. 431.

While various writers have stated that so far as is known the only native food-plant of *Galerucella cavicollis*, Lec. (cherry leaf-beetle) is *Prunus pennsylvanica*, L. (pin cherry), the author records having found this beetle feeding in North Carolina on the leaves of the fire azalea, *Rhododendron calendulaceum*, while pin cherry in the neighbourhood was apparently uninfested. In Ithaca, N.Y., in 1917, the beetle was also found feeding on the leaves of a species of *Azalea*.

Blackman (M. W.). **Apple Tent Caterpillar.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, p. 432.

The author comments upon the statement made in the Seventeenth Report of the State Entomologist of Connecticut that *Malacosoma americana*, F. (apple tent caterpillar) has practically disappeared from many localities in that State in 1917, probably owing to the effects of parasites or other natural enemies. A similar disappearance of this insect has been noticed in the neighbourhood of New York. In this locality wild cherry trees that in preceding years had been entirely stripped of their first crop of leaves were observed to show no sign of defoliation. Examination revealed the fact that very large numbers of the larvae in the nests were dead, and it was estimated that less than 1 per cent. of them had survived and that the ultimate mortality might be expected to be still greater. This is attributed to the weather conditions of the spring of 1917. From 18th to 22nd April the maximum daily temperature at Syracuse was from 66° to 71°, the minimum varying from 42° to 51°. It was during this period that the eggs of *M. americana* hatched. The weather continued unusually cold, the mean temperature for May throughout the State showing an average deficiency of 8°. During this period the buds of wild cherry ceased to develop, and frequent rainfall prevented the larvae from feeding, so that most of them were killed by starvation before the return of normal conditions. That the death of the larvae was not due to parasitic or predaceous enemies was proved by their small size (less than ¼ inch) and by the fact that their bodies were unmutilated and their newly begun tents uninjured.

De Ong (E. R.). **An Outbreak of Field Crickets.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, pp. 433–434.

The field cricket, *Gryllus integer*, became so abundant during May and June 1917 as to do severe damage in the Sacramento Valley, California, climatic conditions having been favourable for its development. Crops were attacked during April and May, crowds of the crickets constantly migrating over roads or other intervening spaces. A flock of terns on one occasion was seen feeding upon the crickets,

not an insect surviving on the ground where they had fed. The greatest damage was caused in vineyards and orchards, where the new growth was eaten off, death to the plant frequently resulting. Bran mash poisoned with arsenic gave very little success; the most successful method proved to be the flooding of the orchard or vineyard for a few hours. This drove the crickets away for a time and gave the plants an opportunity to recover. By 1st June the crickets had completely disappeared.

PETTIT (R. H.). **Thrips injuring Peaches.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 5, October 1918, pp. 434–435.

Frankliniella (*Euthrips*) *tritici*, Fitch, which is well-known to injure strawberries, is recorded as blemishing the skin of peaches, producing shallow, gummed scars on the fruit, which spoil its appearance. While the peaches are quite small and developing rapidly patches of slightly discoloured fuzz can be seen, which are found to contain the thrips, and the skin underneath is scarred. As the damage all seems to be done before the pits begin to harden, that is, before thinning time, many of the blemished fruits can be removed during thinning. The injury is apparently most severe in the highest, driest and warmest parts of the orchards and during seasons when the spring is hot and dry.

FAUST (E. C.). **A New Tyroglyphid for Western Montana (Acar.).**—*Entom. News, Philadelphia*, xxix, no. 9, November 1918, pp. 336–340, 1 plate.

This paper describes *Rhizoglyphus sagittatae*, sp. n., taken in Western Montana, where it was found feeding upon the juicy parts of new leaves of the balsam-root plant, *Balsamorrhiza sagittata*. A description of the mite is given and its relation to the allied species *R. hyacinthi* and *R. rhizophagus* is shown in a table.

FERRIS (G. F.). **The Alleged Occurrence of a Seasonal Dimorphism in the Females of certain Species of Mealy Bugs (Hemiptera; Coccidae).**—*Entom. News, Philadelphia*, xxix, no. 9, November 1918, pp. 349–352.

Various authors have expressed the opinion that the females of certain species of *Phenacoccus* and *Pseudococcus* are seasonally dimorphic. The present paper is written to show that in certain of these cases the alleged dimorphism does not exist, and the author questions whether it ever occurs among these insects. In the case of *Pseudococcus agrifoliae*, Essig, the types examined by the author contain specimens of three species belonging to as many different genera. One of these is that previously described by Ehrhorn as *Ripersia villosa*, another is a new species that will be described elsewhere as *P. quercicolus*, and the third, which is represented only by immature specimens, is unmistakably a species of *Ceroputo*. The only apparent reason for regarding these as forms of the same species is the fact that they were found upon the same host; morphologically they are very different. *P. quercicolus* is quite common on oaks in the vicinity of Stanford University, and has only one generation in a year. The winter is passed in the first or second larval stage, maturity being reached in May or June.

Essig is quoted as saying that it is very probable that the same dimorphic forms exist in *Pseudococcus artemisiae*. The author, having examined the types of this species, finds it identical with *Erium lichtensioides*, Ckll., a species that has but one generation in a year in the neighbourhood of Stanford University. There occurs, however, upon the same host a species of *Pseudococcus*, at present undetermined, that may have given rise to the confusion.

A case of seasonal dimorphism in *Phenacoccus acericola* was recorded by King. The author attributes this statement to confusion of *P. acericola* with *P. comstocki*, Kuw., which occurs on maple in the eastern States. *Pseudococcus trifolii*, Forbes, has similarly been described as having dimorphic forms, but it is probable that this is also a case of confusion with another species, *P. maritimus*, Ehrh.

ROEPKE (W.). ***Mertilia malayensis*, Dist., een "Bloemwants" (Capside) schadelijk voor Orchideen.** [*Mertilia malayensis*, Dist., a Capsid injurious to Orchids.]—*Teysmannia, Batavia*, iv, 1918, pp. 201–212, 4 plates.

In December 1917 an orchid-grower applied to the Salatiga Station (Java) for advice regarding a pest which was identified as the Capsid, *Mertilia malayensis*, Dist., described in 1904 from the Malay Peninsula, but hitherto unrecorded from the Malay Archipelago, where however it appears to be widespread in Java and where *M. brevicornis*, Popp., and *M. ternatensis*, Dist., have also been observed.

All stages of *M. malayensis* are briefly described. Like other Capsids it deposits its eggs in the plant-tissue, but very near the surface. They are exceptionally difficult to find even when abundant. The duration of the egg-stage is not known. The first moult takes place immediately after the larva hatches and before it begins to feed, and another five or six moults occur before the adult stage is reached. The larvae are gregarious. Adults were obtained on 1st and 2nd March 1918 from larvae hatched on 1st February, four weeks earlier. The weather was cool and damp and this probably retarded development. Adults were observed to live for over two months. Both larvae and adults are very shy, and if disturbed for any length of time the former disappear among the orchid roots, while the latter, which are not ready fliers, take to wing. *M. malayensis* is most easily caught in the morning when torpid with the cold. At mid-day it shelters in the shade. No natural enemies were observed. The injury is due to the numerous punctures on both sides of the leaves, on the flower-stalks and on the roots. The leaves turn yellow and fall. If the insects disappear entirely the plant may recover, but growth will be seriously retarded. *M. malayensis* is therefore a dangerous pest of orchids, especially *Phalaenopsis amabilis*.

Spraying with an American contact poison, Harbas oil, proved ineffective, but surprising results were obtained with a stomach poison used in East Africa against the coffee bug [*Antestia variegata*], namely, sodium arsenite $3\frac{1}{2}$–5 oz., $3\frac{1}{2}$–5 pints warm water, 2 lb. sugar or molasses. Within an hour several Capsids were dead and all in the cage had perished by the next day. Unfortunately the orchids also died within a fortnight. Further experiments could not be undertaken, and collection, as practised against *Helopeltis*, is advised.

Jardine (W. M.). Director's Report 1916-17.—*Kansas Agric. Expt. Sta., Manhattan*, 1917, 50 pp. [Received 23rd November 1918.

Life-history studies were made during the year of several insects, including the Hessian fly [*Mayetiola destructor*] and the chinch-bug egg-parasite [*Eumicrosoma benefica*] under controlled temperature and moisture conditions. With regard to *M. destructor*, 85° F. and 75 per cent. humidity are apparently optimum conditions for development. The direction of migration of the larvae is predetermined by the orientation of the egg, the degree of inclination of the leaf having no influence in this connection. The importance of wind as a factor in the distribution of this species has been confirmed. Adults were caught by screens as far as two miles from any infested fields. It is found that the earlier preparations for the seed-bed are begun, the fewer are the flies that emerge. Experiments in the control of the corn ear-worm [*Heliothis obsoleta*] indicate that injury decreases with the increase in the number of applications of dust spray, and that a gun is more effective for applying the dust than a cheesecloth bag. Aphids were found to have a direct connection with apple-blight, which in every case developed upon Aphid-infested trees. In the cultivation of fruit-trees, the use of lucerne as a companion crop was found to encourage the buffalo tree-hopper (*Ceresa bubalus*, F.). Investigations on shade-tree insects included studies in the emergence of canker-worm moths. The moths emerged from 5th January to 21st April, the maximum emergence being from 17th to 21st March. *Aonidia juniperi* (cedar scale) was discovered on cedars in the spring of 1915 and within a year it had nearly destroyed the trees which it infested. Two Chalcid parasites were found to be a valuable check on its increase. An outbreak of the green bug [*Toxoptera graminum*] in Southern Kansas caused considerable injury to wheat, maize and sorghum. Many millions of parasites were successfully imported, but failed to reduce the numbers of this Aphid. The life-histories of many species of May beetles and wireworms have been worked out, and investigations upon termites secured much valuable data.

LEGISLATION.

Repeal of Proclamation under Quarantine Act 1908-1915 prohibiting Importation of Citrus Plants (including Citrus Fruits).—*Extract from Commonwealth Australia Gazette, Melbourne*, no. 145, 12th September 1918.

By this proclamation the prohibition of the importation into Australia of citrus plants, including citrus fruits, in pursuance of the Quarantine Act of 1908–1915, is repealed.

ENTOMOLOGICAL NOTICE.

Dr. J. C. Hutson of the Imperial Department of Agriculture for the West Indies has been appointed Government Entomologist in Ceylon.

Bernard (C.) & Kerbosch (M.). Mijten Antastingen op Kina, Thee enz. [Mite Injury to Cinchona, Tea, etc.]—*Meded. Proefstation voor Thee, Buitenzorg*, lx, 1918, 16 pp., 7 plates.

The four mites dealt with in this paper are *Tetranychus telarius*, L. (*bimaculatus*, Harv.), *T. bioculatus*, W.-M., *Tarsonemus translucens*, Green, and *Brevipalpus obovatus*, Donn. It is believed that the present is the first record of the occurrence of the two last-named on cinchona. *T. telarius* has not yet been found on tea; it has been observed on *Manihot*, *Ricinus*, *Cinchona*, *Hevea*, *Papaya* and *Clitoria*, and to these must now be added two Leguminosae used as green manure plants, *Desmodium tortuosum* and *Sesbania aegyptiaca*. Infested young cinchona plants are stunted and deformed, and the older leaves are curled, while the younger ones shrivel up. *T. bioculatus* is less polyphagous than the preceding species. Though common on tea it does not appear to do serious damage in Java, where it also occurs on coffee and *Ixora* spp. *B. obovatus* is a serious pest of tea in Java. It has also been observed to infest severely a species of *Jasminum* sometimes grown as an ornamental plant on tea and cinchona estates. *Tarsonemus translucens*, which did rather serious injury to tea during the past dry season, must now be considered as also a serious pest of cinchona, the leaves of young plants being curled and shrivelled by it. The injury due to *Tarsonemus translucens* is increased by infestation by thrips.

It is not advisable to allow these four mites to increase unchecked, and direct measures are desirable. The latter are facilitated by the fact that infestation is chiefly confined to cinchona in seed-beds. In addition it is advised that during the wet season the plants should be removed from the seed-beds and planted out, when their more vigorous growth is held to be an important factor in causing the pests to disappear, probably because the leaves of the larger plants are unsuitable as food. Successful results were obtained by spraying the seed-beds with a saponin solution or by dusting with sulphur. The saponin solution is prepared by boiling 10 oz. of the fruit of *Sapindus rarak* in 3½ pints of water for half an hour. After straining, this concentrate is diluted with 10–15 volumes of water to form the spray solution, which is applied every three days. In dusting, from 5 to 10 gms. (about $\frac{1}{6}$–$\frac{1}{3}$ oz.) of sulphur is used per square metre (about 10½ square feet), the bed being watered previously. Neither method kills all the mites present, but the practical result is satisfactory.

Ultée (A. J.). Verslag over het Jaar 1917. [Report of the Besoeki Experiment Station for 1917.]—*Meded. Besoekisch Proefstation, Djember*, no. 27, 1918, 24 pp.

Experiments made by Mr. P. E. Keuchenius with a trap-bait used in British India against tobacco moths (*Prodenia*, *Agrotis*, *Heliothis*) were unsuccessful. The formula used was: Water 200 parts by weight, cane or Java sugar 400, alcohol 3, ethyl acetate 3. Experiments made to determine if the usual quantity of carbon bisulphide could be safely reduced when fumigating tobacco have already been dealt with [see this *Review*, Ser. A, vi, p. 224].

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MALENOTTI (E.). **Esperimenti fatti in Sicilia nel 1917 contro la Bianca-rossa degli Agrumi** (*Chrysomphalus dictyospermi*, **Morg.**).—[Experiments made in Sicily in 1917 against *C. dictyospermi*, Morg.]—*Ministero per l'Agricoltura, Rome*, 1918, 8 pp.

This report describes work on a large scale undertaken as a result of experiments conducted in 1914 with colloidal calcium polysulphide [see this *Review*, Ser. A., iv, p. 143]. The orange trees were examined on 12th December 1917, 4½ months after the last spraying, and the destruction of *Chrysomphalus dictyospermi* was found to be absolute on very many leaves. Any exception to the general highly satisfactory result was due to lack of skill in spraying. The fruits were quite free from infestation and markings. Untreated trees near the experiment plots were on the other hand very heavily infested. It is pointed out that infestation causes a loss of from 8 to 12 shillings per 1,000 oranges, the corresponding cost of spraying being under 5 pence.

JONES (T. H.) & GILLETTE (C. P.). **Life-History of** *Pemphigus populi-transversus*.—*Jl. Agric. Research, Washington, D.C.*, xiv, no. 13, 23rd September 1918, pp. 577–594, 5 plates, 1 fig. [Received 21st November 1918.]

As a result of investigations made in the field and laboratory at Baton Rouge, Louisiana, much valuable information has been gathered regarding the life-history and habits of *Pemphigus populi-transversus*. The weather influences to a large extent the dates of appearance of the various stages and the migration of this Aphid. Galls formed by the stem-mothers begin to develop on the petioles of the young leaves of *Populus deltoides* in the spring. They increase in size during the summer and by the time the leaves fall in the autumn reach their greatest diameter of nearly an inch. In July 1916, the percentage of leaf-petioles of *P. deltoides* infested with the Aphids was found to be 25·2 out of 1,175 leaves examined, these being taken from both large and small trees. Winged migrants of *P. populi-transversus* have been found in the galls as early as 1st June, the percentage of galls containing winged migrants, as well as the number in each gall, increasing as the season advances. These winged migrants from the galls fly to various cruciferous plants, and have been found on the leaves of these as early as 30th August, and as late as 31st October. The greatest migration probably takes place during October. Though the maximum distance they can traverse in flight is not known, it is probable that they, as well as the sexupara, may be carried long distances by wind. The winged migrants give birth to viviparous females that start colonies on the roots of crucifers, upon which they feed. They have been found at the roots of cabbage, turnip, Brussels sprouts, rape, *Coronopus didymus* (a weed that is sometimes eaten), and *Roripa* sp. While a severe infestation of *P. populi-transversus* on the roots of crucifers may be indicated by the wilted condition of the leaves, a slight or moderate infestation is scarcely noticeable in the portions of the plant above ground. A white, cottony material secreted by the Aphids generally becomes apparent about the roots of the plants. In the spring the winged migrants fly from crucifers to poplar trees, where they give birth to sexuales, which are usually found in crevices

on the trunks and branches. The average number of sexual individuals arising from one of these appears to be six. These forms take no food, and after mating the female deposits a single egg. The stem-mother from this egg makes its way to the young leaves of the poplar where it settles down on a petiole and a gall begins to form about it.

The second part of this paper, by C. P. Gillette, consists of descriptions of the stages of *P. populi-transversus* and its gall.

PEMBERTON (C. E.) & WILLARD (H. F.). **Work and Parasitism of the Mediterranean Fruit-fly in Hawaii during 1917.**—*Jl. Agric. Research, Washington, D.C.*, xiv, no. 13, 23rd September 1918, pp. 605–610. [Received 21st November 1918.]

Information with regard to the extent of infestation of fruit in Hawaii during 1917 by the Mediterannean fruit-fly (*Ceratitis capitata*, Wied.) and of the extent of parasitism of this species is given in tabulated form, following the procedure of previous years [see this *Review*, Ser. A, vi, p. 167]. A comparison of the efficacy of the various parasites of *C. capitata* has already been given [see this *Review*, Ser. A, vi, pp. 184, 185]. The total parasitism by all species during 1917 was 14·3 per cent. higher than in 1916.

CHAPAIS (J. C.). **Notes on the White-marked Tussock Moth.**—*Tenth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Diseases, 1917–1918*; *Quebec*, 1918, pp. 23–24. [Received 23rd November 1918.]

This is a popular account of this well known pest of orchards and forest trees in Canada.

BRYCE (P. I.). **Some Injurious Insects of Ste. Anne de Bellevue, 1917.**—*Tenth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Diseases, 1917–1918*; *Quebec*, 1918, pp. 46–48. [Received 23rd November 1918.]

Meromyza americana (greater wheat-stem maggot) caused considerable injury to wheat and barley. The larvae and pupae are found near the heads, generally under the sheathing-leaf, inside the hollowed-out stem. Pupation takes place about 25th July, adults emerging by 8th August. *Mayetiola destructor* (Hessian fly) did some damage to spring wheat. Maize showed damage to the leaves resembling that caused by *Sphenophorus inaequalis* (corn bill-bug).

Vegetable and root crop pests include *Phorbia* (*Chortophila*) *brassicae* (cabbage root maggot), which was checked wherever card-board discs were used. During June, *Epitrix cucumeris* (potato flea-beetle) occurred on potatoes and *Crepidodera helxines* on willow; *Phyllotreta armoraciae* (horse-radish flea-beetle), *P. sinuata* and *P. vittata* (turnip flea-beetles), *Haltica chalybea* (grape-vine flea-beetle) and *Psylliodes punctulata* (hop flea-beetle) also occurred. *Leptinotarsa decemlineata* (Colorado beetle) was abundant, but was controlled by poisoned Bordeaux spray. The predaceous Pentatomid, *Perillus* sp., was found feeding on it in considerable numbers. *Depressaria heracliana* (parsnip web-worm) occurred on the flower-heads of parsnips. *Ceramica* (*Mamestra*) *picta* (zebra caterpillar) was abundant on

succulent weeds in autumn, but did little damage to vegetables. *Diabrotica vittata* (striped cucumber beetle), *Crioceris asparagi* (asparagus beetle) and *C. duodecimpunctata* were fairly numerous.

On orchard fruits, *Cydia pomonella* (codling moth) emerged in late June and early July. Probably for this reason the larvae were unable to enter the calyx end of the fruit and much side injury resulted. *Estigmene acraea* (salt-marsh caterpillar) skeletonises the leaves. The tussock moths, *Hemerocampa leucostigma* and *Orgyia* (*Notolophus*) *antiqua*, were destructive to shade and fruit trees, but the eggs and pupae were attacked by parasites. *Mineola indiginella* (leaf crumpler) attacked unfolding apple leaves in small numbers. *Phigalia titea* was taken on 30th April on silver maple. *Coleophora fletcherella* (cigar case-bearer) was abundant on apple. *Datana ministra* (yellow-necked caterpillar) fed on apple and service-berry (*Amelanchier*). *Ceresa bubalus* (buffalo tree-hopper) scars the branches of various shade and orchard trees.

Minor pests of fruit included *Monophadnus rubi* (raspberry sawfly), *Aegeria* (*Sesia*) *tipuliformis* (imported currant borer) and *Pteronus ribesi* (imported currant sawfly). *Cymatophora ribearia* (currant spanworm) did some damage to flowering currants (*Ribes cereum*). The worst pest of grapes is *Typhlocyba comes* (leaf-hopper). Blackleaf 40 (1:100) is a good contact poison and should be applied under pressure to the under-side of the leaves. Clean cultivation destroys the insects hibernating in neighbouring sods and weeds.

Shade and forest tree pests included *Hyphantria cunea* (fall webworm) on *Fraxinus* (ash); *Trichiocampus viminalis* (poplar sawfly) on Carolina poplar and *Caligrapha scalaris* (birch Chrysomelid) on willow.

FONTANEL (P.). **Ants and Aphids.**—*Tenth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Diseases, 1917–1918*; *Quebec*, 1918, pp. 52–57. [Received 23rd November 1918.]

The relations existing between ants and Aphids are discussed, the object of the paper being to show that ants are on the whole injurious to plants through their relations with Aphids, and that the smaller the plants are the greater is the injury done by them. Ants may be beneficial in that they may accidentally kill some Aphids or keep them in their nests and so prevent them from injuring the plant; they also absorb the matter secreted by Aphids which frequently injures the plant by blocking the stomata. On the other hand, injury is done by the ants in protecting Aphids from weather and natural enemies, in the propagation of Aphids on their food-plants, and in the isolation of plants from the soil, as these frequently have their roots uncovered by the ants in order to secure nourishment for the Aphids.

SWAINE (J. M.). **The Control of the White-marked Tussock Moth.**—*Tenth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Diseases, 1917–1918*; *Quebec*, 1918, pp. 58–69, 2 plates. [Received 23rd November 1918.]

The importance of shade trees in the streets of such cities as Montreal and the economic loss owing to their injury by insects is discussed. The control measures advocated against wood-boring grubs are the

cutting out and destroying of the larvae with a sharp knife or wire, or killing them in their burrows by injecting carbon bisulphide with a syringe and closing the openings with putty, soap or clay. After 24 hours the dead larvae should be removed if possible, the cavities disinfected and then filled with cement or putty. Among defoliating caterpillars one of the most important is the white-marked tussock moth [*Hemerocampa leucostigma*], of which there is one generation annually in Quebec. The life-history and habits of this insect are described, natural enemies enumerated and remedial measures recommended [see this *Review*, Ser. A, v, pp. 174, 309 & vi, 330].

LOCHHEAD (W.). **The most common Plant Lice or Aphids.**—*Tenth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Diseases, 1917–1918*; *Quebec*, 1918, pp. 79–91, 6 figs. [Received 23rd November 1918.]

A popular account of North American Aphids is given, with notes on their method of increase, natural enemies and control. The chief economic species attacking cereal and farm crops, fruits, garden plants and shade and forest trees are enumerated, with a brief account of each. A partial list of double-host Aphids is given, with a useful key to the chief economic genera.

VIDAL (G.). **A propos de la Pyrale.** [Concerning *Sparganothis pilleriana.*] —*Progrès Agric. Vitic., Montpellier*, lxx, no. 41, 13th October 1918, pp. 343–345.

It is well-known that the best measures, whatever they may be, against *Sparganothis pilleriana* on vines are never absolutely successful; the most that can be said is that they check in a greater or less degree the ravages of the moth. The author is of opinion that while the individuals that survive are in part those that have not been reached by the boiling water or insecticides applied to the tree, there are also very many that may have hibernated elsewhere than on the tree, in vegetable débris in the vineyard for example, and which neither thorough cultivation of the ground nor humidity of the soil can always destroy. Several instances are described of the infestation of new vine-shoots which had only just appeared above-ground after having been under the soil throughout the winter. As the infestation was regularly distributed over an area of about five acres, it is hardly probable that wind could have brought the insects; it is therefore concluded that the young larvae find sufficient protection on the ground for hibernation, that even deep digging does not destroy them, and that in spite of it they can find their way in the spring to the vine-shoots. This theory also explains the difference in size of individuals that may be found on the same vine, the largest being those left on the vine-stock, the smallest those that have hibernated on the soil. Intermediate examples may be those that have migrated to the vine after some period of growth on other plants, this moth being found on about 30 species of plants, including practically all that grow in vineyards; a list of the commoner ones is given. Many of these plants dry up or are cut down before the larvae can complete development upon them and these then migrate to vines, giving rise to the heavier infestation that is often noticed towards the end of May or in June.

It seems necessary in view of these conclusions that some further measure should be taken that would destroy the caterpillars on the ground and on the plants or prevent them from ascending the vines. It is hoped that investigations will be made to determine a method for doing this. It is remarked with regard to humidity that only a prolonged inundation such as those of 20th May 1917 and 7th May 1918, when the vine-stocks were under water for 2 or 3 days, is sufficient to kill all the caterpillars.

BONET (J.). **La Cochylis et l'Eudémis vaincues.** [*Clysia ambiguella* and *Polychrosis botrana* conquered.]—*Progrès Agric. Vitic., Montpellier*, lxx, no. 43, 27th October 1918, p. 395.

The complete success of the following treatment of vines against *Clysia ambiguella* and *Polychrosis botrana* is vouched for by several vine-growers. The grapes should be absolutely covered with a dust spray of quick-lime, as fresh as possible, before the 10th June, again before 10th July and again before 5th August. It is said that the larvae of these moths do not touch grapes so treated, while the formation of mildew and fungous diseases is also prevented by the lime.

GODET (C.). **Rapport sur l'Activité de la Station d'Essais viticoles à Auvernier en 1917.** [Report on the Work of the Experiment Station of Vine-growing at Auvernier in 1917.]—*Annuaire Agric. Suisse, Berne*, xix, no. 2, 1918, pp. 196–218, 10 figs.

Clysia ambiguella caused great damage in some localities during 1917 and even the vines in the Experiment Station did not escape in spite of two nicotine treatments. It is estimated, however, that crops have been increased by about 40 per cent. by the remedial measures undertaken. Titrated nicotine was mixed with ordinary Bordeaux mixture in the proportion of 1 : 100 for these sprays, which are applied by a hose with a bent jet. Experiments have been made with various other insecticides, the results of which are given in a table. Several of these were effective and caused a considerable increase in the crop. Golazine I (non-miscible with Bordeaux mixture) gave the best results. Light-traps with acetylene lamps were also tried ; it is difficult to judge the efficacy of these and further tests are desirable.

DAVIS (J. J.). **The Control of Three Important Wheat Pests in Indiana.**—*Purdue Univ. Agric. Expt. Sta., Lafayette, Ind.*, Circ. no. 82, August 1918, 11 pp., 6 figs.

The two important insect pests of wheat in Indiana are the jointworm [*Isosoma tritici*] and Hessian fly [*Mayetiola destructor*]. They occur throughout the State, but chiefly in the wheat belt of southern Indiana. A third wheat pest which usually occurs in northern Indiana and which was unusually destructive during 1917 is the wheat midge [*Contarinia tritici*].

Isosoma tritici has but one brood annually and affects the wheat in the spring only, causing a hardening of the stem at the point where the egg is deposited. The larva, developing in the stem, causes the stalk to bend and fall above the point of infestation, which varies

from 3 to 20 inches above the ground. The adult issues in late April or early May in southern Indiana and towards the end of May in the northern section. The falling of the straws is not apparent until shortly before the harvest, which is about the first or second week in June in central Indiana. In order to destroy this pest the stubble should be ploughed to a depth of 6 or 8 inches and afterwards harrowed, a treatment which may be delayed till winter if necessary, although the best results will be obtained if ploughing is done as soon as possible after cutting. As regards date of sowing, experiments in Indiana have shown that joint-worm infestation is the same in early-sown plots and those sown 10 days after the "fly-free" date. Sowing as soon as possible after the "fly-free" or "safe date" is nevertheless recommended. Fields infested with joint-worm should be cut as close as possible and the straw used as bedding. Manure containing the straw should be allowed to accumulate till spring, and should be ploughed under as soon after application as possible.

The Hessian fly has at least two generations each year. The autumn brood larva kills the plants outright as a rule, and that of the spring brood causes the stalks to fall, resembling the joint-worm injury in this respect, but differing from it in the absence of the hardening of the stalk and the presence of the larva or brown pupa (flax-seed) beneath the leaf-sheath just above a joint and not within the stem. Autumn infested plants have broader leaves of a darker green colour that stand up stiffly, the central shoot being usually dead. The pest can be controlled by proper cultural methods, such as the ploughing in of the stubble to a depth of 6 or 8 inches immediately after cutting, the destruction of self-sown wheat by harrowing or otherwise, and the sowing of wheat after the "fly-free" date, which should be universally practised, even in years when the Hessian fly is not abundant. The planting of fly-resistant varieties of wheat is also recommended, bearded wheats, as a general rule, being less injured than other varieties.

Contarinia tritici appears in June and oviposits in the immature wheat heads. The reddish larvae dwarf the grains and cause the infested part of the wheat head to ripen prematurely. The insect hibernates in small cocoons just beneath the surface of the ground. Sometimes the larvae are to be found in chaff after the grain has been threshed, but the possibility of this as a source of infestation in the following spring is apparently slight. Control is effected by ploughing under stubble, though rotation of crops and time of sowing are also important. The use of fertilisers, such as acid phosphate, to hasten maturity is to be recommended in the case of all three pests.

DEAN (G. A.). **Report of State Entomologist, Manhattan.**—*Rept. Kansas State Entom. Commiss. for 1915–1916, Topeka,* 1916, pp. 5–9.

Careful inspection during 1915 showed a reduction of infestation by San José scale [*Aspidiotus perniciosus*], though two newly infested localities were found.

In 1916 the scale had only increased in one district, where very little spraying for its control had been done. In well-cared-for orchards the situation seems to be in hand and the scale finds great difficulty in becoming established. No new infested localities were found during the year.

HUNTER (S. J.). **Report of State Entomologist, Lawrence.**—*Rept. Kansas State Entom. Commiss. for 1915 & 1916, Topeka,* 1916, pp. 11–15.

During the biennial period covered by this report, a number of insect pests were intercepted and destroyed, including:—*Carabus granulatus, Lachnosterna, Eriosoma* (*Schizoneura*) *lanigerum,* rusty tussock moth [*Orgyia antiqua*], *Lepidosaphes ulmi* and *L. beckii.*

Coffee Borer.—*Planters' Chronicle, Bangalore,* xiii, no. 40, 5th October 1918, p. 667.

In 1917 adult coffee-borer beetles [*Xylotrechus quadripes*] did not begin to emerge until November. In 1918, however, as a result probably of the very severe drought, adult beetles began to emerge in the second week of September. Since extensive injury is to be feared unless there is sufficient rain, planters are advised to scrub their coffee as previously recommended [see this *Review,* Ser. A, vi, p. 74]; the treatment should be carried out once in the third week of October and again in the first week of November, the younger trees receiving the greatest attention.

NICHOLLS (H. M.). **Fungicides and Insecticides.**—*Agric. & Stock Dept. Tasmania,* Bull. no. 59, 1918, 15 pp.

This bulletin deals at length with the usual fungicides, combined fungicides and insecticides, and insecticides, both internal and contact, and gives full instructions for their preparation and application.

NICHOLLS (H. M.). **The Currant Borer** (*Aegeria tipuliformis*).—*Agric. & Stock Dept. Tasmania,* Bull. no. 69, 1917, 8 pp., 5 figs. [Received 3rd December 1918.]

Aegeria tipuliformis (currant borer) has been found capable of doing a great deal of damage in Tasmania. In some districts in New Zealand and in America it has put an end to currant growing altogether, in spite of all attempts to control it, and the same may happen in some parts of Tasmania, if no efforts are made to check its spread. While black currant is the preferred host, red and white varieties are also attacked, as well as gooseberries. The larvae bore into the young shoots and then tunnel down the centre of the branches, eating out the pith, till they very often reach nearly to the roots. The bushes in consequence become sickly and their productiveness is reduced, while the young shoots and fruit-bearing wood often die altogether. The tunnels in the stems encourage fungous growths, which frequently complete the destruction of the bushes. Old infested bushes always have a stunted and gnarled appearance and are sometimes full of stumps where dead branches have rotted off. They bear very little fruit and what they do produce is small in size.

The eggs of *A. tipuliformis* are laid on the young wood, generally close to where a bud or shoot arises, the incubation period probably being from 10 to 12 days. The larva, upon hatching, proceeds to bore its way into the wood, and on reaching the pith it generally turns downward. Towards the end of the winter a hole is eaten through the wood and almost through the bark at the side of a shoot,

and there pupation occurs. In late spring the pupa forces itself partly out of this hole and the adult escapes. It is probable that in Tasmania the insects pair very soon after emergence and that eggs are laid during December.

Constant vigilance is necessary to keep this moth in check, as it increases very rapidly, while its habits protect it from natural enemies and render spraying useless as a control measure. The best method as yet known is to inspect the bushes and cut off and burn all wood that has been attacked, large numbers of larvae and pupae thus being destroyed before they can develop into adults. This should be done in Tasmania chiefly during October, when the larvae have crawled into the smaller branches to pupate. Bushes that have been badly attacked should be dug out and burnt. In badly infested ground it is advised to plant suckering cuttings, so that as old infested branches are removed there is young, fruit-bearing wood to take its place.

MILLER (D.). **The Economic Bearing of Hover-Flies.**—*New Zealand Jl. Agric., Wellington*, xvii, no. 3, 20th September 1918, pp. 129–135, 7 figs. [Received 4th December 1918.]

Syrphid flies, which are probably of greater value in the control of Aphids than are Coccinellids, are well represented in New Zealand, not so much by the number of species as by the abundance of individuals.

The two most abundant and important species are *Syrphus novae-zealandiae* and *Melanostoma fasciatum*, the larvae of which devour large numbers of Aphids and injurious caterpillars.

Another Aphid-destroying species, *S. viridiceps*, Macq. (*obesus*, Hutt.), which is very common in Australia, is sometimes found in New Zealand, but is not yet well-established. The larvae of *S. ropalus* and *S. ortas*, two less abundant species, have been found attacking the caterpillars of the moth *Venusia verriculata*, which feed on the foliage of the cabbage-tree (*Cordyline indivisa*), and of *Xanthorhoe praefectata* and *Melanchra steropastis*, which attack the leaves of the New Zealand flax (*Phormium tenax*). The larvae of *Phthorimaea operculella* (potato-tuber moth) and *Plutella maculipennis* (*cruciferarum*) (diamond-back moth) are preyed upon by the larvae of both *S. novae-zealandiae* and *M. fasciatum.*

About 10 species of the larger injurious forms of hover-flies are known in New Zealand. These include *Eristalis tenax*, which has frequently been recorded as causing larval myiasis in man and domestic animals, entering the digestive organs by means of water-cress or drinking-water, and is now well established throughout the country, and *Merodon equestris* (narcissus-fly), the larvae of which burrow in narcissus and daffodil bulbs. Some bulbs recently imported from Japan have also been found infested by the larvae of this or an allied species, so far undetermined.

COLLARD (J. W.). **Citrus-fruit Culture in New Zealand. Advice to Growers.** — *New Zealand Jl. Agric., Wellington*, xvii, no. 3, 20th September 1918, pp. 154–162. [Received 4th December 1918.]

The insect pests attacking citrus-trees that give the most trouble to growers in New Zealand are :—*Chrysomphalus aurantii* (*Aspidiotus*

coccineus) (red scale) which is the worst to deal with, *Chrysomphalus* (*A.*) *rossi* (black scale), *Diaspis santali*, *Icerya purchasi* (cottony cushion scale) and thrips, all of which may be successfully combated by red-oil emulsion; *Saissetia* (*Lecanium*) *oleae* (olive scale); black aphis [*? Toxoptera aurantii*]; and leaf-roller caterpillar [*Tortrix postvittana*], which has caused considerable damage during the past few years by eating off the young shoots and flower-buds of young trees, and may be dealt with by the use of lead arsenate at a strength of 4 or 5 in 100, at intervals during spring and summer.

KERLE (W. D.). **The Peanut.**—*N.S.W. Dept. Agric., Sydney*, Farmers' Bull. no. 119, August 1918, 39 pp., 16 figs. [Received 7th December 1918.]

This bulletin reviews the possibilities of the cultivation of the pea nut (*Arachis hypogaea*) in Australia and records the better known insect pests of this plant throughout the world. No attacks by insects on it have as yet been recorded from Australia.

DUPORT (M.). **Rapport à Monsieur le Président de la Chambre d'Agriculture du Tonkin et du Nord-Annam sur les Travaux effectués en 1914 à la Station Entomologique de Cho-ganh.** [Report to the President of the Chamber of Agriculture of Tonkin and North-Annam on the Work carried out in 1914 at the Entomological Station of Cho-ganh.]—*Supplement to Bull. no. 102, Chambre Agric. Tonkin, Nord-Annam*, January-February 1915, 46 pp. [Received 2nd December 1918.]

Investigations on the Longicorn beetle, *Xylotrechus quadripes*, Chevr. (coffee borer), and other coffee pests at the entomological station of Cho-ganh, established for that purpose in 1914, are described. Owing to interruption of the work by the War many points in the habits of this pest remain to be elucidated, and none of the treatments proposed have as yet given any practical measure of success. It is hoped, however, that the new data obtained may be of some interest and assistance to coffee planters who are troubled by this, the principal enemy of the coffee crop.

Studies undertaken with a view to determine the life-cycle of *X. quadripes* were begun in June 1914. In a climate such as that of Tonkin, the life-cycle varies considerably according to the season, while other factors also intervene to accelerate or retard the development of the larvae and their pupation. From rearing experiments from June to September it was found that on two plants infested in June and July the life-cycle occupied a minimum of four months, and that the same plant after the emergence of adults may still contain nymphs and larvae in different stages of development, all arising from eggs deposited about the same date. An attempt was made to induce *X. annularis*, which lives in dried bamboo, to oviposit on coffee plants, but without success. Other species more closely allied to *X. quadripes* may possibly oviposit on coffee, but the author is doubtful whether such infestation occurs naturally. *X. buqueti*, for example, has been taken in the close vicinity of coffee plants, but not on them. The opinion is expressed that *X. annularis* should be placed in the allied

genus *Chlorophorus*, and is considered identical with the species from Tonkin described by Fairmaire as *Chlorophorus tonkinensis*.

Numerous experiments have been made with the object of discovering the food-plants of *X. quadripes* other than coffee. Some evidence was obtained of oviposition on a wild species of *Gardenia*, and oviposition on a cultivated *Gardenia* was observed one hour after the introduction of adults of *X. quadripes*. Tea plants also became readily infested in the experiment cages, while several species of *Ixora* have been attacked by the larvae, without, however, any adults being obtained.

The description of *X. quadripes*, Chevr., given by Bourgoin is quoted, and it is stated that it does not apply exactly to the coffee-borer of Tonkin, particularly as regards coloration, the insect being very variable in this respect, as well as in form and size.

Only one species of coffee-plant, *Coffea arabica*, is as yet regularly attacked at Tonkin by *X. quadripes* and the question has been considered whether another and more resistant variety could not be advantageously substituted. The probability is that as other species became more numerous the borer would attack these in default of its preferred variety, but perhaps not with the same intensity as in the case of *C. arabica*. *Coffea robusta* is as yet very scarce at Tonkin, so that its possible immunity is not definitely established. In Java, where *X. javanicus*, Cast. & Gory, occurs, *C. arabica* is the only variety of coffee attacked. The Chari variety is very little grown at Tonkin, but a larva of *X. quadripes* was found living in it. *Coffea liberica*, which has been cultivated in Tonkin almost as long as *C. arabica*, has not previously been known to be attacked, but the author found some plants that had died of a root disease riddled by galleries of this beetle, which had every appearance of having been made before the death of the plants. The damage to this variety does not however appear as marked as in the case of *C. arabica*.

The times of emergence of the adults have been studied, and it is hoped that eventually it will be possible to foresee the principal periods, and to treat the plantations in time to prevent emergence and consequently the infestation of fresh plants. Although emergence of the adults occurs almost throughout the year, excepting during the coldest weather, the numbers vary with the season. From January to the end of March the adults, even if ready for emergence, do not leave the galleries while the weather is cold; they rest inactive until there have been two or three sunny days before they come out. At this time a careful watch should be kept for infested plants, though frequently the signs of attack are not easily discernible. After the beginning of April the infested trees are more in evidence and emergence from these should be promptly prevented. In May, June and July very few adults appear in the trunks, nymphs and larvae being chiefly found. At the end of July, when the heavy summer rains come, infested plants wilt suddenly and are easily recognised. Only larvae are found in them at this time. In the author's opinion, the most dangerous period at Cho-ganh in 1914 was August, September and October, adults then being numerous on the stems. In November and December, and through the other three winter months, emergence is reduced to a minimum, and during this time it is only possible to remove from time to time the affected plants that are dying or broken

by wind. By treating the coffee-plants before they wilt, it is found that the stems very rarely show emergence holes, and generally contain only larvae that require another month's development when placed in cages before transforming to adults. After emergence, mating and oviposition occur rapidly, sometimes on the same day. The adults take no food, although they may live three weeks or a month if the weather is sufficiently cold to keep them inactive; normally, adult life lasts a fortnight or less.

Eggs are deposited on the main stems with much care and after much deliberation on the part of the female, in such a manner as to offer every advantage to the larva for penetrating the stem and at the same time of protection from ants or other enemies. The number of eggs deposited by one female varies greatly and is difficult to determine, but it seems probable that one individual under normal conditions may lay from 50 to 80 eggs, only one or two being deposited in one place, and several plants being commonly attacked. The eggs are soft and adapt themselves to the cavities into which they are thrust. The larva upon hatching penetrates the stem, leaving behind the egg covering, which serves to indicate the entrance hole, and begins to construct a gallery, generally at first almost perpendicular to the surface of the stem, then running under the bark and gradually turning to the interior. As the larva nears maturity, the gallery frequently almost girdles the stem, so that it readily breaks off at that point. Before pupating, a cell is constructed near the bark, in which transformation takes place. The larval stage is very variable, even in individuals from eggs laid on the same day, lasting from 3 to 6 or 7 months. Being completely protected in their galleries, the larvae cannot be destroyed by enemies, and in fact no parasitism, either by insects or fungi, has ever been noticed in this species. The larvae are very robust, and poison applied to the stems does not seem to deter them from entering, or, in fact, to have any effect upon them. The only possible methods of control therefore are the suppression and destruction of infested plants and the prevention, if possible, of oviposition. The larvae when mature cease feeding and remain inactive for about eight days. The pupal stage, passed within the pupal cell, is generally from 2 to 3 days, sometimes longer in winter.

In considering remedial measures it must be borne in mind that these must be inexpensive, in view of the numbers of trees to be dealt with, and easy of application, since only native labour is available. It is advisable to avoid the vicinity of forests or heavy undergrowth in choosing a site for a coffee plantation, and a new plantation should not be started in the neighbourhood of an old one that is already infested. It is necessary to watch the plantation almost all the year round and cut out infested plants as early as possible, before they have begun to decay. The signs of borer attack are described. The first indication is generally a yellowing of the leaves; the blossoming of infested plants is frequently abundant and sudden, although the plants appear no more vigorous than their neighbours, and berries in all stages of ripeness may appear simultaneously on one tree. Sometimes small branches, generally at the head of the tree, may die off. It is a serious sign when termites are found on the plants, for these profit by the old emergence holes and galleries of the borer to enter and attack the wood. In this case there is frequently a visible

thickening of the tissues following the line of the galleries, and the bark is very much cracked. The only certain sign of borer attack is the emergence holes and this can be verified by shaking the stem, holding it near the top, when it will probably break off in the worst infested spot. Once cut away, the infested plants should be burnt as quickly as possible. It is not sufficient to break off the infested parts of the plant, and it is better to saw them off below the lowest point of infestation. Even in this case there are frequently galleries left that do not appear in the section and from which adults will emerge later; while if the main stem is cut fairly high too many lateral branches are formed, the growth being green and vigorous but not assisting future production. The ideal method would be to dig up the plant entirely and plant a fresh one, if this were possible. After June or July infested plants should be cut down to a maximum height of six to eight inches above ground-level, only one or two vertical branches being allowed to grow. Plants so treated show promise of good production, but further results must be awaited before recommendations can be given with any certainty. In older plantations it would seem that with even severer treatment good results might be obtained. It is suggested that all plants should be well hilled up and the trunks washed, allowing only a few vertical branches that can be easily watched to grow.

Various attempts to coat the stems of coffee plants with earth, generally mixed with iron or copper sulphate, have previously been made without much success, as the normal growth of the plant is sufficient to break the coating, which moreover will not stand rain and breaks off in flakes at the slightest shock. Tests have therefore been made with other substances. The author considers it useless to attempt to treat with washes trees more than four years old, unless these have been thoroughly pruned. Plants treated with washes would also not be entirely protected from borer attacks, as the beetle, instead of ovipositing low down on the main stems, as is usually the case, would do so at the base of lateral branches which could not be protected. Efficient washing will, however, materially lessen the damage and should be done twice during the year, once in the early months and once after the heavy summer rains. Various compositions of glue were tried, but did not give good results, the wash running gradually off the plant to the ground and forming from the first only a very thin coating which, while sufficient to prevent oviposition, is not sufficient to prevent the emergence of adults. Tar and coal-tar were also tried, the physical properties of the latter rendering it preferable to the other substances, but even this cannot prevent the adults from biting through the coating and making their escape. The practice of singeing the stems to destroy the eggs before hatching is not recommended. The period of incubation being from 6 to 8 days it would be necessary to singe the stems every sixth or seventh day to produce the desired effect. Moreover, this could hardly be done during the flowering period, nor during the long period of gathering the crop.

Experiments with poisons to be absorbed by the roots with a view to poisoning the larvae that feed upon the plant have as yet given very little success; in many cases the plant seems to be severely injured,

while in no cases has any detrimental effect on the larvae been observed. These tests will however be continued with various toxic substances.

Minor pests of coffee observed at Cho-ganh include a larva of which the adult is unknown but may prove to be the Chrysomelid, *Sagra purpurea*. This larva lives in the soil at the base of coffee plants, sometimes at a depth of nearly two feet, and feeds on the roots. The presence of this insect cannot be recognised until the plant suddenly wilts. The stem then breaks off with the least shock at the point most severely attacked, generally at a depth of about 4 inches from the ground; the larva can generally be found in the soil around or in the broken stump left in the earth. Considerable damage is caused by this pest, which attacks particularly young and newly set plants, or those still in the nursery, though older plants also may be attacked. A very similar larva, which may be the same species, occurs at Cho-ganh in the wood of dead or dying candle-nut (*Aleurites moluccana*), Japanese lily, teak, lemon-tree, etc. These species are being studied. *Xyleborus coffeae*, Wurth, was of rare occurrence in 1914; if this species becomes troublesome the infested branches should be cut and burnt as soon as possible. *Zeuzera coffeae*, N., in the larval stage damages the interior of the stems of coffee. This moth was abundant in the early part of 1914, but is not likely to increase to a dangerous extent as it is heavily parasitised by a Hymenopterous larva. Other food-plants of this pest are Japanese lily, litchi, guava (both wild and cultivated), *Acalypha* sp. and other brushwood plants.

Miscellaneous Lepidopterous pests include a species found on the branches in silken nests; a Psychid larva living on the foliage in a case; the larvae of *Altha adala*, Moore, and *Thosea sinensis*, Wlk.; and *Euproctis fraterna*, Moore, living in colonies on the leaves and young shoots.

Coccids are, with the exception of *X. quadripes*, the most serious pests of coffee at Tonkin; fortunately a number of Dipterous and Hymenopterous parasites assist greatly in keeping them in check. *Pseudococcus citri*, Risso, is the most dangerous species, and is frequently accompanied by *Saissetia hemisphaerica*. Ants are attracted by these scales and give trouble by constructing their nests near the plants attacked. An unidentified Coccid occurs on the foliage of *Coffea liberica* and a species of *Pseudococcus* on the wood under the bark.

ANDREWS (E. A.). **Notes on Insect Pests of Green Manures and Shade Trees.**—*Qtrly. Jl. Scient. Dept., Indian Tea Assoc., Calcutta*, Pt. 2, 1918, pp. 29–34. [Received 3rd December 1918.]

The Lycaenid butterfly, *Lampides* (*Polyommatus*) *baetica*, L., oviposits in the flower-buds and on the pods of leguminous plants, the newly hatched larvae boring into the pod and feeding on the seeds. When mature, they emerge from the pod to pupate on the plant. This butterfly occurs in all parts of India, and it is common in Assam in the cold weather. It is also a pest of *Crotalaria juncea* (sunn hemp) and *Cajanus indicus*, two common green manure crops. No remedial measures are known except hand-picking and the destruction of affected pods.

Argina argus, Koll., a Hypsid moth, oviposits on the under-side of leaves of *Crotalaria* spp. The eggs are laid in clusters and the larvae

have been found boring into the pods of *C. sericea* in April and feeding on the leaves of *C. striata* in May, and other species in June. Spraying is recommended in cases where the leaves only are attacked. Though it pupates in the soil, it cannot be destroyed by hoeing in the crop, as the pupal stage extends over 4–6 days only, and there are several broods in a year. A Hymenopterous parasite has been found attacking the larvae and may prove to be of value in controlling the pest. *A. cribraria*, Clerck, a closely allied species, attacks the leaves of *Crotalaria sericea*. There are usually three broods in the year.

Euproctis scintillans, Wlk., is a Lymantrid moth, the caterpillars of which attack mangos, various species of *Hibiscus*, sunn hemp, linseed and castor, and have been found in June feeding on the leaves of *Cassia fistula*. It has a larval period of a fortnight and a pupal period of four days only.

The Arctiid, *Utetheisa pulchella*, L., is probably the worst pest of sunn hemp in India and is very common in Assam. The eggs are laid, either singly or in small clusters, on the lower surface of the leaves of the food-plant. The larvae hatch in 3 or 4 days, pupation being effected in a flimsy cocoon between the leaves of the plant, and the moth emerging in from 5 to 7 days; the whole life-cycle takes about a month. The plants attacked are *Crotalaria juncea*, *C. striata*, and other species. Remedial measures are very difficult, spraying and hand-picking being useful on small plots, but impracticable in the field. The chief hope of control lies in the possible discovery of a larval parasite, though spraying with lead chromate might be of value.

The larva of the Pyralid, *Terastia egialealis*, Wlk., bores in the young stems and shoots of *Erythrina indica*, having been found in January. A closely allied species *T. meticulosalis*, attacks *Erythrina* in a similar manner in other parts of India, the attack resulting in the dying back of the shoots, which eventually break off. Infested trees should be cut back to sound wood and the bored shoots burned.

A small black fly, the larva of which feeds on the seeds of *Cajanus indicus* in April, has been found to be identical with the species known as the tur-pod fly or red gram *Agromyza* in other parts of India. The eggs are laid in the mature flowers or very young pods, and the larvae on hatching eat a groove round the seed. The larval stage lasts for about a week, pupation taking place inside the pod, and the fly emerging in a few days. Pods affected become distorted and twisted, their collection and destruction being the only remedy known, though a Hymenopterous parasite attacking the fly has been recorded.

TUNSTALL (A. C.). **Spraying Experiments in 1917.**—*Qtrly. Jl. Scient. Dept., Indian Tea Assoc., Calcutta*, Pt. 2. 1918, pp. 38–45, 3 plates. [Received 3rd December 1918.]

A series of experiments to ascertain whether the spray fluids in common use as fungicides and insecticides cause a sufficiently large increase in the leaf of tea in normal health to warrant their application is described. The results showed that the increases in yield were not sufficiently large to cover the cost of spraying, which therefore is of no practical value.

ANDREWS (E. A.). **An Experiment on the Treatment of Red Spider by Insecticides.**—*Qtrly. Jl. Scient. Dept. Indian Tea Assoc., Calcutta*, pt. 2, 1918, pp. 46–49. [Received 3rd December 1918.]

A trial of insecticides against the mite, *Tetranychus bioculatus*, W.-M., on a badly affected area during the second week in May was unfortunately rendered futile by a rainfall of nearly 4½ inches in 1 hour 35 minutes some 3 days after their application, the result being that both the pest and the remedies were washed off.

Examination of leaves plucked on the day of application, however, showed that sulphur, lime-sulphur, Cya sulphur, and Vermisapon were perfectly efficient, and Cook's nicotine spray so nearly so, that, having regard to the fact that on some leaves all the mites were dead, it must be concluded that faulty application was responsible for the escape of 2·5 per cent. of the mites. Crude oil emulsion was not quite so good as the above, while sodium silicate had very little effect.

RITCHIE (A. H.). **Annual Report of Entomologist.**—*Jamaica Dept. Agric. Ann. Rept. for Year ended 31st March 1918, Kingston*, 1918, pp. 34–40.

During 1917-1918, the sweet potato was injured by *Cylas formicarius*, F. (sweet potato weevil), largely owing to lack of selection of vines and unseasonable planting. Slips consisting of the growing tip of the vine have the advantages of being weevil-free, of establishing themselves more quickly and of yielding better results. The most important remedial measures are selection of slips, sanitation of the fields and rotation of crops. A new weevil, *Palaeopus costicollis*, Mshl., causing injury very similar to that of *C. formicarius* and *Euscepes batatae*, was reared from sweet potatoes in May. *Euscepes porcellus*, Boh., not previously recorded from Jamaica and possibly an introduction, was reared from larvae breeding in the stems of sweet potato just at the ground-level. It has been recorded generally from Central America, and also occurs in Porto Rico and Cuba. Sweet potato chips for potato flour manufacture were injured by a Scolytid beetle, *Hypothenemus ritchiei*, Samps. It should be readily controlled by proper drying and storage. *Pilocrocis tripunctata*, F. (sweet potato leaf-folder) occasionally becomes destructive; the larvae, however, can be controlled by spraying with lead arsenate at the rate of 2 lb. to 40 gals. water. A Cassidid, *Metriona propinqua*, was recorded as injuring sweet potato foliage, but never became so numerous or destructive as *Coptocycla flavolineata*, Latr., reported in the previous year.

The yam crop was injured by *Aspidiotus hartii*, Ckll. (yam scale), which sometimes kills out plants entirely. Control consists in dipping the yam heads before planting in strong lime-sulphur, 1 gal. concentral (32° Bé.) to 10 gals. water. Reinfestation, however, may come from crawling larval stages blown by the wind or carried on the feet of birds or larger insects; hence a new yam patch should preferably be to leeward of a previously infested one. Since 1st January 1918, the Federal Horticultural Board of the United States Department of Agriculture has forbidden the importation of yams and sweet potatoes grown in Jamaica owing to the prevalence of the weevils, *Cylas formicarius*, F., and *Euscepes batatae*, Waterh.

Field peas suffered extensive losses in yield due to injuries by weevils in the field and in storage. The species chiefly concerned were *Bruchus phaseoli*, Gyl., and *B. quadrimaculatus*, F., the loss being mainly due to delayed harvesting and bad storage. There is no known method of field treatment, and remedies lie in proper and immediate care of the crop. Complaints of injuries by cutworms during 1917–18 were more numerous than usual owing to the hurried reclamation of uncultivated land without extended fallowing operations or treatment with poison-bait. The burning-over of such land as a measure against cutworms and crickets (*Gryllus assimilis*, Wlk.) is to be discouraged, since the impoverishment of the soil due to humus destruction more than outweighs the small and indeed questionable gain to the crop.

Maize suffered the usual losses from the corn-worms, *Heliothis obsoleta*, F., and *Laphygma frugiperda*, S. & A. Young plants may be protected :—(1) by mixing a little over ½ teaspoonful Paris green in one quart maize meal till it has a greenish tint and sprinkling a pinch of this in the heart of each unfolding plant ; (2) by lightly dusting lead arsenate and wood ashes in equal parts, or Paris green one part, road dust, white lime, wood ashes 15 parts, from a fine muslin bag into the heart ; (3) by spraying lead arsenate ¼ lb. to 4 gals. water from a tin mist sprayer into the heart of the plant ; (4) by hand picking ; (5) by ground cultivation with the scuffle hoe ; (6) by preparing a well-tilled and rich seed-bed to ensure the quick establishment of the plants. Injury by weevils can be avoided by proper storage and fumigation by heat or carbon bisulphide.

Bananas throughout the island are generally infested with red spider, which, however, is not abundant, nor as a rule injurious, though it may become a pest at times and have a serious devitalising effect if not taken in hand. Experiments with Black-leaf 40 and lime-sulphur were being carried out when the hurricane of 23rd September 1917 totally destroyed the field. Since the same date the coconut beetles, *Sternodontis damicornis* and *Macraspis tetradactyla*, L., have both been taken repeatedly in a somewhat unusual location, namely, the heart of the coconut, their presence there being probably due to the prevalence of injured fermenting tissue in the crown. The latter beetle and *Scalmus interstitialis*, Esch., have both been found breeding in decaying stumps and felled coconut stems about plantations. Other species collected were *Strategus titanus* (not *S. anachoreta* as has been stated) and *Metamasius sericeus*, Oliv. *Pseudococcus nipae*, Mask., attended by ants has become numerous on newly established nuts, and the bagworm *Oiketicus* sp. has been reported damaging coconut foliage.

The pineapple weevil, *Metamasius ritchiei*, Mshl., again claimed a large percentage of the crop in 1917, the recommendations made in 1916 for its control not having been generally acted upon. It is a pest difficult to control directly, once it has gained a footing, as its life is passed in the seclusion of the pine tissues, and reliance must be placed on preventive measures.

Anastrepha fraterculus, Wied., has been found to preponderate among fruit-flies bred from mangos, guavas, *Spondias dulcis*, *S. mombin* and *S. purpurea*, but the Mediterranean fruit-fly (*Ceratitis capitata*) does not appear to be present in the Island.

A Chalcid, *Bephrata cubensis*, Ashm., was found in October infesting the fruits of *Anona squamosa* (sweet sop), on which it is also found in Florida and Cuba.

Other insect pests collected were:—*Ptychodes trilineatus*, L. (three-lined fig-tree borer); *Oncideres cingulatus*, Say, girdling the almond, *Terminalia catappa*; *Apate terebrans*, Pall., and *A. submedia*, Wlk., the latter bred from orange and pomegranate; and *Pachymerus* (*Caryoborus*) *gonagra*, F., a well known Indian pest found breeding in tamarind pods.

A termite, *Arrhinotermes simplex*, Hagen, was responsible for serious damage to stored timber. Samples of wheaten flour from a bakery were found to be heavily infested by a beetle, *Tribolium confusum*, Duv., the larvae of a flour moth, and a mite, *Tyroglyphus farinae*. Many complaints were received of damage done to stored dress-stuffs and clothes by the brown house-cricket, *Gryllodes sigillatus*, Wlk.

Young dogwood trees (*Piscidia erythrina*) were severely attacked and retarded in growth by the Psyllid, *Euphalerus nidifex*, Schwarz, which distorted the young tips. Severe damage was done to roses in May by a Chrysomelid beetle, *Metachroma* sp., which was however controlled by spraying with lead arsenate at the rate of 1 oz. per gal. water. The Lycid beetle, *Thonalmus militaris*, Dalm., occurred on sugar-cane and the Fulgorid, *Ormenis perpusillus*, Wlk., on coffee, but did no damage.

Insects injuring vegetables included:—*Spartocera fusca*, Thb., on potato foliage; *Diaphania nitidalis*, Cram., on cucumbers and pumpkins; *Pieris* sp., on cabbages; *Prodenia dolichos*, F., on turnips; and *Fundella pellucens*, Z., on cowpea pods.

Woods (W. C.). **The Biology of Maine Species of** *Altica*.—*Univ. Maine Agric. Expt. Sta., Orono*, Bull. 273, October 1918, pp. 149–204, 4 figs.

A detailed description is here given of three new species of *Haltica* (*Altica*) from Maine:—*H. corni*, on dog-wood, *H. rosae*, on wild rose, and *H. ulmi*, on elm. These are all forms that in the past would have been treated as varieties of *H. ignita*, Ill., which the author considers a composite species.

Keys are given to the adults and early stages of the Maine species of this genus, including the blueberry flea-beetle, *H. torquata*, Lec.

They can all be controlled by spraying with lead arsenate. Parasitic flies have been bred from the adults of two species and a predaceous bug has been found attacking the larva of another. They are all susceptible to fungous and bacterial diseases, which doubtless play a large rôle in holding them in check.

Nougaret (R. L.). **Grape Mealybug** (*Pseudococcus bakeri*, **Essig.**)—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 9, September 1918, pp. 511–514, 3 figs. [Received 6th December 1918.]

Pseudococcus bakeri (*P. maritimus*, Ehrh.) (grape mealy-bug) is a pest of grapes in California for which at present no reliable remedial method can be recommended. This scale is not particularly adapted to the grape but is omnivorous, feeding on citrus, pear, walnut, and

some ornamental plants, both in the open air and in hot-houses, and at times on certain species of bulbs and roots when exposed above ground.

Hibernation takes place in the larval stage and begins immediately after hatching in September and October. The larvae begin feeding in March and April, hiding in crevices and under loose pieces of bark where they have access to the cambium layer. The individuals of this brood attain maturity in June and oviposit during that month, the larvae feeding on the green tender canes and leaves and being found in the bunches of grapes when adult, or when almost full grown. There are two distinct generations a year, oviposition occurring in June to July, and September to October. The eggs usually hatch in from 7–10 days, though in the autumn they may take as long as 2 weeks.

This mealy-bug causes little or no injury to the vine, nor are the grapes affected in their development or in the percentage of sugar they contain, even when heavily infested. The damage caused consists solely in a depreciation of the market value of the grapes owing to the condition of the bunches, the honeydew forming a sticky mass containing the white flocculent egg-sacs and cast skins. Grapes such as these may be dried, but make an inferior raisin; the best use for them is the distillery. Unless the bunches are heavily infested, the scale is seldom seen on the outside berries, its presence being only detected by the honeydew on them.

Conditions best suited to the insect are shade and seclusion, and protection from bright light, wind and sudden change of temperature. When a bunch of grapes is picked these conditions change, and the insect leaves the bunch sooner or later and crawls about, hiding in some crack or crevice of the picking box, whence it may reach other boxes stacked in the packing shed. Special attention and precautionary measures should therefore be taken in the packing shed, the most important being:—The exclusion of all bunches showing signs of honeydew and the rejection of boxes containing such grapes; the disinfection of boxes that have contained infested bunches, either by dipping them in boiling water, by subjecting them to a jet of steam so as to reach every crack and crevice and all the surfaces of the box, or fumigating them with hydrocyanic gas or sulphur.

Maskew (F.). **A Record of Six Years' Work.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 9, September 1918, pp. 521–522, 1 fig. [Received 6th December 1918.]

A list of some of the more destructive insects that have been kept out of the State of California by means of its quarantine system during the years 1912–1918 includes:—Mediterranean fruit-fly (*Ceratitis capitata*), Mexican fruit-fly (*Anastrepha ludens*), gipsy moth (*Porthetria dispar*), pink bollworm of cotton (*Pectinophora gossypiella*), Colorado potato beetle (*Leptinotarsa decemlineata*), plum curculio (*Conotrachelus nenuphar*), melon fly (*Dacus cucurbitae*), brown-tail moth (*Nygmia phaeorrhoea*), Mexican cotton boll weevil (*Anthonomus grandis*), alfalfa weevil (*Hypera variabilis*), sweet potato weevils (*Cylas formicarius* and *Euscepes batatae*), Japanese beetle (*Adoretus umbrosus*) and Oriental peach moth (*Cydia molesta*).

WOOD (W. B.). The Oriental Peach Moth: a Japanese Fruit Insect recently introduced into the United States.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 9, September 1918, pp. 523–528, 8 figs. [Received 6th December 1918.]

Cydia (Laspeyresia) molesta, Busck (oriental peach moth), recently introduced into the United States, has become firmly established in the eastern States. Larvae were first discovered in the twigs and fruit of peach late in 1915 in the vicinity of Washington, D.C. A small amount of injury noticed during the two preceding years had been attributed to *Anarsia lineatella,* L. (peach twig-borer). The view that this insect is an importation from Japan is strengthened by the fact that it has been recognised as a pest in that country for about 10 years, causing considerable injury to peaches and pears. So far, there is no evidence of its presence on the Pacific coast. Particulars of its life-history and parasites, as well as such remedial measures as are possible, have already been given at length from other sources [see this *Review,* Ser. A, vi, pp. 369,373].

MACKIE (D. B.). Some Results of Gypsy Moth Presence in Massachusetts.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 9, September 1918, p. 536. [Received 6th December 1918.]

The control of the gipsy moth [*Porthetria dispar*] cost the State of Massachusetts in 1917, £70,000 for lead arsenate alone. When to this is added the cost of labour, equipment, etc., and an additional sum amounting to more than one-third of the above expended by private individuals on poisons, etc., some idea may be gained of what this pest is costing the State annually.

However, as a compensation, the entire system of forestry practice has been radically changed owing to the presence of the moth. As a result of the information gained by intensive studies of its feeding habits a definite plan of procedure has been developed and is being rigidly adhered to. All self-sown growth of oaks, birches and other species which serve as food-plants is kept cut out and conditions are made unfavourable for their propagation. Further, spray machinery has been vastly improved, giant power sprayers having been constructed, largely of bronze, and perfected till they are capable of throwing a spray over the highest forest trees, thus materially reducing spraying costs.

MACKIE (D. B.). Some Aliens we do not want, why we do not want them, and how they may arrive. iii. The European Cornstalk Borer.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 9, September 1918. pp. 541–544, 5 figs. [Received 6th December]

Pyrausta nubilalis (European cornstalk borer) was introduced into California from Europe in a cargo of hemp (*Cannabis sativa*), and has already established itself and spread north and south of its point of entry. Though a most destructive pest of maize, being closely allied to *P. vastatrix,* the chief maize pest in certain regions of the Orient, it feeds on a number of other plants, including sorghum, and is believed occasionally to infest sugar-cane. It feeds by boring in the stalk, generally entering at the node and working upwards.

There is no particular seasonal brood, though the moths appear to be more numerous from May to August. The larvae also may be found during several months, the length of their existence being very variable, lasting in some cases over 6 months.

The exact distribution of this species has never been definitely recorded, though it occurs throughout the Philippine archipelago and probably also in China. No practical measures, other than cultural methods, are possible for its control, which is chiefly effected by a small Tachinid fly.

ESSIG (E. O.). **A Record of the Corn Earworm attacking Beans and a Suggestion as to the Reason of the Outbreak.**—*Mthly. Bull. State Commiss. Hortic., Sacramento,* vii, no. 9, September 1918, pp. 544-545. [Received 6th December 1918.]

An unusual attack of the corn ear worm [*Heliothis obsoleta*] occurred during July in the bean fields of one county in California, the caterpillars becoming abundant very suddenly and injuring the bean pods, especially those of Lima beans, 20-75 per cent. of the first setting being destroyed. Holes were made in the pods, which were usually shed, and in some cases entirely devoured. The caterpillars were of all stages, and adult moths were quite abundant in the fields, ovipositing on the bean plants, and being most active at night. The first pupae were taken in the soil on 20th July, but many must have been there prior to this, giving rise to a continual emergence of moths from the beginning of July. The use of powders, including neutral lead arsenate and acid powders mixed with hydrated lime or with kaolin and applied to all parts of the plant with a hand duster, seemed likely to give good results. The usual formula for poison bran mash for cutworms was used against the larvae with good effect.

The pest probably originated in a district of 400 acres along the coast devoted to tomato culture, tomatoes being a favourite food-plant.

STEVENS (V. G.). **Report of a Recent Investigation for Evidence of Alfalfa Weevil in Alfalfa Fields adjacent to the Salt Lake Railroad.** —*Mthly. Bull. State Commiss. Hortic., Sacramento,* vii, no. 9, September 1918, pp. 546-548, 1 fig. [Received 6th December 1918.]

A survey of the lucerne fields adjacent to the Salt Lake Railroad, into which it was feared that the alfalfa weevil [*Hypera variabilis*] might have been introduced, showed no trace of this pest.

The insect most abundant in all fields was *Colias* (*Eurymus*) *eurytheme* Boisd. (alfalfa butterfly).

ARMITAGE (A. H. M.). **Some Work of the Branch Insectary.**—*Mthly. Bull. State Commiss. Hortic., Sacramento,* vii, no. 9, September 1918, pp. 548-551. [Received 6th December 1918.]

During the month of September 1918, 45,125 individuals of *Cryptolaemus montrouzieri* were liberated on a number of citrus estates, 17 of which were infested with *Pseudococcus citri*, 10 with *P. citrophilus* and 2 with *P. longispinus*. One small shipment of larvae destined for France was dispatched. A strong colony of *Leptomastix* also was

liberated in practically new territory, and a number of adult *Rhizobius ventralis* were forwarded for liberation in San Francisco.

The examples of *C. montrouzieri* distributed were largely those that had been collected by means of hand-screens provided with funnels, a method that enabled two collectors in 16 hours to obtain 25,000 adults, and the following week an additional 35,000 in a district where the beetles had completed their work and there was no further need for them.

A comparison between two equally infested orchards, in one of which the Coccinellid was not introduced until the mealy-bug infestation had almost defoliated the trees and there was practically no fruit left, and in the other in which it was liberated early in the season with the result that there was little indication of any previous infestation, shows that this biological method is valuable as a preventive rather than as a cure.

MASKEW (F.). **Quarantine Division. Reports for the Months of July and August 1918.**—*Mthly. Bull. Cal. State Commiss. Hortic. Sacramento*, vii, no. 9, September 1918, pp. 552–555. [Received 6th December 1918.]

The following pests were intercepted during the months of July and August:—From Central America: *Pseudococcus* spp., *Aspidiotus cyanophylli*, and *Icerya* spp. on bananas. From China: Unidentified weevil larvae in sweet potatoes, and Lepidopterous larvae in dry herbs. From Japan: Lepidopterous larvae in peanuts and dry persimmons; *Poliaspis pini* on pine trees, and *Pseudococcus* spp. on *Daphne*. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapples; larvae of *Dacus cucurbitae* in cucumbers; *Coccus hesperidum* on *Cassia nodosa*. From New South Wales: *Aleurodes* sp. on holly. From Tahiti: *Lepidosaphes beckii* and *Morganella maskelli* on oranges. From Pennsylvania: Tortricids on swamp mandrake; Aphids on geraniums; *Cerataphis lataniae* and *Pseudococcus* spp. on unidentified plants; *Aspidiotus cyanophylli* on a guava plant. From Utah: *Lepidosaphes ulmi* on unidentified foliage; *Cydia pomonella* on pears. From Washington: *Pseudococcus* spp. on poinsettia plants. From Nicaragua: An undetermined weevil in tamarinds. From Mexico: Unidentified Coleoptera on roots; weevils in palm nuts. From Peru: *Phthorimaea operculella* and larvae of an unidentified weevil in potatoes.

SMITH (L. B.). **Spinach Blight and its Transmission by Insects.**—Separate [*n. d.*] from *Eleventh Ann. Rept. State Entomologist* [*Virginia*], 1916–1917 [*sine loco*], 21 pp., 6 figs. [Received 7th December 1918.]

The information contained in this pamphlet has already been abstracted from a previous paper [see this *Review*, Ser. A, vi, p. 453].

KELLER (G. N.). **Investigations as to the Supply and Use of Tobacco Products for Insecticidal Purposes.**—*Jl. Dept. Agric. & Tech. Instruction for Ireland, Dublin*, xviii, no. 2, 1918, pp. 180–186. [Received 7th December 1918.]

The neglect of spraying on account of the high price of nicotine is the cause of considerable loss every year to the horticultural interests

of the United Kingdom, where economic difficulties and disadvantages have discouraged the growing of tobacco for insecticides. The immense quantities of refuse tobacco stalks that are regularly abandoned to the Crown have a considerable potential value as a source of nicotine and plant foods, especially potash, of which there is at present a great shortage.

The Department has devised a cheap and efficient means of utilising the insecticidal and manurial value of refuse tobacco stalks which could be practised on any farm, and which consists in dissolving the nicotine out of tobacco stalks in a sufficient quantity of water to make the extract suitable, without further dilution, for immediate application as a spray fluid against orchard and garden pests. The manurial value of the spent stalks can be utilised, and their use for illegal purposes prevented by composting them with farmyard manure on the premises where the extraction process is carried out.

The obstacles that prevent the economic use of these stalks by agriculturists and manufacturers in the United Kingdom are excise restrictions and the patent rights of foreigners. During the fiscal year 1915–16, 7,626,725 lb. of refuse tobacco stalks were abandoned to the Crown, the present wholesale value of the available nicotine, nitrogen, phosphoric acid and potash of which is approximately £75,415.

HAGAN (J.). **Spraying Experiments.**—*Jl. Dept. Agric. & Tech. Instruction for Ireland, Dublin*, xviii, no. 2, 1918, pp. 186–188, 3 figs. [Received 7th December 1918.]

This paper, an appendix to the preceding one, deals with the experimental use of an extract made from refuse tobacco stalks against green Capsid bugs, which during the past 8 or 9 years have occasioned great loss to apple growers in Co. Armagh.

Various methods of extraction were tested, namely, (1) steeping the stalks three times in cold well-water, (2) steeping them twice in cold well-water, the stalks being pressed after the first steeping, (3) steeping the stalks once in cold well-water and pressing once, (4) steeping them three times in fresh cold well-water; the total amount of water used in each case being about 1 gal. to 1 lb. of stalks. Of these, the last was the most satisfactory, as the quantity of stalks and amount of water were such that a paraffin oil barrel could be used advantageously, and the expensive and tedious process of pressing was not involved.

A block of apple trees all badly infested with Capsid bugs and larvae of Tortricids and the winter moth [*Cheimatobia brumata*] was selected for spraying, lead arsenate (at the rate of 3 lb. to 40 gals. extract) being added to make the spray effective against both biting and sucking insects. The trees were sprayed immediately before the flowers opened, and soon after the fruit had set. It was found that the four different extracts gave results which were equally satisfactory, and therefore three steepings of the tobacco stalks are not absolutely essential. In another test, with trees very badly infested with Capsid bugs, trees sprayed twice with No. 4 extract showed about 2 per cent. of fruit injured by the bugs, while unsprayed trees of similar varieties showed about 75 per cent.

The extracts were also tested with good results on apple aphis [*Aphis pomi*], apple sucker [*Psylla mali*], gooseberry aphis [*Aphis grossulariae*] and rose aphis [*Aphis rosae*].

RUTGERS (A. A. L.). **Verslag van den Directeur van het Algemeen Proefstation der A.V.R.O.S.. 1 Juli 1917—30 Juni 1918.** [Report of the Director of the General Experiment Station of the General Association of the Rubber-planters of the East Coast of Sumatra, 1st July 1917 to 30th June 1918.]—*Medan*, 1918, 44 pp. [Received 13th November 1918.]

The insects received during the year included the following pests of *Hevea*: The borers, *Platypus solidus*, Wlk., *P. schultzei*, Strohm., and *Xylothrips flavipes*, Ill.; all these appear to be secondary pests chiefly found in trees injured by lightning. Two scales, *Aspidiotus* sp. and another species believed to be *Saissetia* (*Lecanium*) *nigra*, also occurred. On one estate the weeds were attacked by caterpillars of *Prodenia* and *Ergolis*, and it was feared that the removal of weeds would result in infestation of the *Hevea*. *Psyche snelleni*, Heyl., proved very troublesome on one estate. The conical shelters of the larvae are formed of pieces of bark; they usually feed on bark or on moss growing on bark, but in this case they attacked fresh one-month-old bast a short distance above the tap-wound, making holes resembling neglected tap-wounds. Only some of the larvae feed in this manner; most of them are found much higher up the stem and branches. Their life-history is similar to that of other Psychids. The newly hatched larvae spin their miniature cases from the material of that of the parent and begin feeding. These small larvae readily attach themselves to the clothes of passing persons or to the skin of animals, and this is their sole method of spreading. Collection of the cocoons is the remedial measure advised.

Tea pests included *Pachypeltis humeralis*, Wlk., or another closely-allied Capsid bug, and a Lygaeid bug; a Braconid was also present which is probably more beneficial than injurious. *Helopeltis* has not yet been observed on tea in Sumatra. Injurious Capsids reported from the East Coast include *Helopeltis sumatranus*, Rpke., *H. theivora*, Waterh., found on *Ficus hispida*, and *H. antonii*, Sign., on cacao. Lamellicorn beetle larvae injured the roots of young tea plants in seed-beds.

Liberia coffee was infested by the scale, *Pulvinaria psidii*, Mask., but the injury was very slight. A sample of coffee was found to be severely infested by the coffee beetle, *Araecerus fasciculatus*. As carbon bisulphide was difficult to obtain sulphur fumigation was resorted to, but proved useless against the eggs and perhaps against the larvae also. This beetle or a very closely related species also attacks the seeds of *Crotalaria* and *Tephrosia*.

Among coconut pests were:—*Brachartona catoxantha*, which on one estate defoliated about 3,000 palms, but was checked by collection and by a Tachinid parasite, aided by a Chalcid and a Clerid beetle, *Callimerus* sp. Coconuts were also attacked by *Hidari irava*, Moore, Hispid and Cucujid beetles, *Oryctes rhinoceros*, *Xylotrupes gideon*, and *Rhynchophorus ferrugineus*. Copra was infested by a Tineid moth, by a Nitidulid beetle (*Carpophilus* sp.), a Cucujid (*Laemophloeus*

sp.), and the Clerid, *Necrobia rufipes*, De G. It is advisable to keep copra from old nuts separate from that obtained from young ones, as the latter is more severely attacked. Sulphur fumigation was tried, but the results were not lastingly successful, and the method at present employed is to keep the copra constantly turned over. Oil-palm pests included a Psychid, *Lansdownia bifenestralis*, Snell., and a Limacodid, *Orthocraspeda trima*, Moore. Collection is the only measure available against the latter. Miscellaneous pests included termites, which are said to be kept away by planting *Euphorbia neriifolia* around the threatened areas, probably owing to its irritant sap; this method is being tested.

SILVESTRI (F.). **Descrizione e Notizie biologiche di alcuni Imenotteri Calcididi parassiti di Uova di Cicale.** [A Description of and Biological Notes on some Chalcids parasitising the Eggs of Cicadas.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, pp. 252–265, 12 figs.

The two Chalcids that parasitise the eggs of *Cicada plebeja*, Scop., and *Tettigia orni*, L., are *Cerambycobius cicadae*, Giraud, which is re-described, and *Centrodora cicadae*, sp. n., of which a description is given. Both *Cicada plebeja* and *Tettigia orni* oviposit from July to early September in the tall stems of herbaceous plants (*Arundo pliniana*) and in the twigs of woody plants (*Acer campestris*). The stems or twigs must be dry and either not hollow, or, if hollow, with walls thick enough to contain the egg-cells, which are about 10 mm. in length in the case of *Cicada* and 5 mm. of *Tettigia* and are bored towards the axis of the stem with a very pronounced downward slope. There are from 11 to 15 cells on a stem; they are placed in a perpendicular line with a spacing of 10 mm. for *Cicada* and 5 mm. for *Tettigia*. The presence of more than one line of cells appears to be due to more than one female or to the same female having pierced more than one row. Each cell contains from 6 to 12 eggs of *Cicada* and from 4 to 5 of *Tettigia*. The larvae appear in October and burrow into the ground.

The adults of *Cerambycobius cicadae* appear at the end of July. They are very active, feed readily on sugary substances and can mate soon after emergence. The female introduces her ovipositor into an egg-cell and deposits an egg on the first of the eggs of the host, and usually visits the other cells also. Incubation requires four days. The larva usually sucks all the eggs in the cell and sometimes finishes feeding early in August. It remains in the cell until the following year, when it pupates. As a rule, the adult emerges in the summer of the following year, but sometimes a further year elapses before emergence.

Centrodora cicadae, sp. n., has two annual generations. The adults from the second generation of the previous year begin to appear early in July. Mating and oviposition take place without delay. The egg is deposited within the egg of the host. Eggs laid on 26th July hatched out on 29th July; the larvae were nearly full-grown on 31st July and the adults appeared on 14th August. These adults give rise to the second generation, the larvae of which remain in the eggs of the host

until the following year. Sometimes two or three parasitic larvae are found in one egg. The degree of parasitism is small; in 1917–1918 perhaps less than 1 per cent. were affected.

SILVESTRI (F.). **Il Genere *Thysanus*, Walker (Hymenoptera: Chalcididae.)** [The Genus *Thysanus*, Wlk.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, pp. 266–271, 2 figs.

This is a re-description of the Chalcid genus *Thysanus*, Wlk., and of the genotype, *T. ater*, Wlk., which has been bred in Italy from the scale, *Aspidiotus ostreaeformis*, Curt., occurring on *Prunus* and *Corylus avellana*, and from *Aspidiotus* or *Asterolecanium* (both scales were found on the twigs) on *Quercus robur.*

Coleóptero *Saperda carcharias*, L., parasitado. [The Beetle, *S. carcharias*, attacked by a Parasite.]—*Bol. Soc. Entom. España, Saragossa*, i, no. 7, October 1918, p. 150.

The fungus, *Entomophthora grylli*, is recorded as infesting *Saperda carcharias*, L. Larvae of this beetle, obtained from a block of *Populus nigra* from the province of Gerona, Spain, were found to harbour the fungus. A female adult was bred, but died in 12 days as a result of the infestation.

BERLESE (A.). **Istruzioni per combattere la Mosca delle Olive (*Dacus oleae*, Rossi).** [Instructions for combating the Olive Fly, *Dacus oleae*.]—*R. Staz. Entom. Agrar., Florence*, 1915, 11 pp., 8 figs. [Received 2nd December 1918.]

This paper describes both the author's and Professor Lotrionte's methods of checking *Dacus oleae* by means of an arsenical poison-bait [see this *Review*, Ser. A, ii, pp. 289 and 452].

DE STEFANI (T.). **Alterazioni cecidiche più frequenti su alcuni Alberi da Frutta in Sicilia.** [The most common Galls on some Fruit Trees in Sicily.]—*Annali R. Staz. Speriment. Agrum. Fruttic., Acireale*, iv, 1916–1917, pp. 147–170, 1 plate. [Received 2nd December 1918.]

The galls recorded in this paper are divided into groups, according to the insects giving rise to them, and into sections, according to the parts of the plant which are affected. Galls due to the action of fungi are not included.

JACK (R. W.). **A Note on the Maize Stalk Borer.**—*Rhodesia Agric. Jl., Salisbury*, xv, no. 5, October 1918, pp. 449–450.

The practice of burning maize stalks during the winter in order to destroy the grubs of the maize-stalk borer [*Busseola fusca*] has the disadvantage of wasting a certain amount of humus that would otherwise be returned to the soil. In view of the fact that many farmers are anxious to follow some procedure by which they may retain the manurial value of the stalks in the rapidly deteriorating soils of some parts of the country, and at the same time prevent the emergence of the moths, a series of experiments was conducted at

Salisbury with a view to determining the depth of dry earth that would prevent emergence. It was found that when buried at a depth of 2 inches most of the moths reached the surface, but all in a crippled condition, the wings being shrivelled and the insects unable to fly. When buried at 4 and 6 inches all died in the soil without being able to reach the surface. The stalks in the field, therefore would have to be covered with loose earth to a sufficient depth during November and December when the moths are emerging. They would have to be laid along the bottom of the furrows during ploughing, and sufficiently deep to escape being caught and dragged to the surface by the harrow. Certain maize growers have reported success in carrying out these operations, which present less difficulties in the more friable soils.

SWAINE (J. M.). **Canadian Bark-Beetles. Part II. A Preliminary Classification, with an Account of the Habits and Means of Control.** —*Canada Dept. Agric., Ottawa*, Bull. no. 14, 6th September 1918, 143 pp., 31 plates. [Received 11th December 1918.]

The object of this bulletin, of which Part I has previously been noticed [see this *Review*, Ser. A, v, p. 399], is to bring together the results of many years' work and to afford a means whereby foresters, students and others may readily identify the species of bark-beetles that are injurious in the Canadian forests. A general account is given of the life-history of the beetles and their habits, the damage they inflict and the means of combating them; the structural characters are also discussed and a preliminary classification of the identified species is included. There are still numbers of undescribed species occurring in Canada. It is pointed out that at the present time the protection and correct utilisation of the timber resources of Canada is of greater importance than ever, and the information contained in the present bulletin should be of inestimable value in preventing the continued loss of timber owing to the depredations of insects. A list of coniferous host-trees, a glossary of technical terms, a bibliography, and an index of species are included.

DAVIS (J. J.). **The Corn Root-Aphis and Methods of Controlling It.**— *U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 891, December 1917, 12 pp., 5 figs. [Received 12th December 1918.]

This bulletin gives a popular account of *Aphis maidiradicis* (corn root-aphis), its seasonal history and habits, its relations with ants, especially *Lasius niger americanus*, and the methods recommended for its control.

CROSBY (C. R.) & LEONARD (M. D.). **Manual of Vegetable-Garden Insects.**—*New York*, The Macmillan Co., 1918, 391 pp., 232 figs., 8vo. [Price $ 2.50].

This book, one of the series of Rural Manuals edited by L. H. Bailey, gives a great deal of information concerning the principal insects that attack market and vegetable crops in North America. The insects are grouped in sections under the heading of the crops affected. At the end of each is a complete list of the insects injurious to the plants dealt with, with a reference to the page on which the description of

each may be found. An account is given of the life-history and habits of each insect, both popular and scientific names being given, and such remedial measures are recommended as have been proved effective under commercial conditions or such as would seem to be worthy of trial. A list of references to papers dealing with the same subject is appended to the account of each insect. The illustrations accompanying the text are numerous and well reproduced, and an adequate index is included. A chapter on insecticides gives an account of the more important materials now employed, with directions for their preparation and use.

PETTIT (H. R.). **Entomological Notes.**—*Qtrly. Bull., Michigan Agric. Coll. Expt. Sta., East Lansing*, i, no. 1, August 1918, pp. 21–22. [Received 12th December 1918.]

Only one outbreak of the army-worm [*Cirphis unipuncta*] was recorded in 1918 up to 1st August, some fields of oats being destroyed. The potato aphis [*Macrosiphum solanifolii*] reappeared as was expected, but in many districts was efficiently controlled by the larvae of Coccinellids. Other Aphids have been recorded from many districts to be parasitised by a species of *Lysiphlebus*. The best remedial measure is a spray of Black-leaf 40 at the rate of ¾ to 1 pint to 100 gals. water, with about 4 lb. common laundry soap added.

COLLIN (J. E.). **A Short Summary of our Knowledge of the Frit-Fly.**—*Ann. App. Biol., Cambridge*, v, no. 2, October 1918, pp. 81–96. [Received 14th December 1918.]

It is only in comparatively recent years that attention has been directed to the losses in the British Isles caused by *Oscinella* (*Oscinis*) *frit* (frit-fly), the damage done to crops, especially oats, in some years being enormous. Roughly speaking, this is a very troublesome pest throughout the whole of the south of England from Cornwall to Kent, in the Eastern Counties (except in the Fen district), and northward in the counties between Wales and the Midlands to Lancashire and Yorkshire, with a few records from Northumberland. It appears to be specially destructive in the counties bordering on the Thames and the Severn, and in Hampshire, Dorset, East Devon and the Isle of Wight. In Wales it has been noted as a pest from counties on the English border, and it has been recorded as doing damage in Ireland and Scotland.

Frit-fly damage occurs also in most of Northern and Central Europe, and attacks by Oscinid larvae have been observed in Canada and Minnesota.

In addition to damage to the young oat plant, subsequent injury to the grain in the panicles is often very great, probably much more so than is generally realised. The returns published by the Board of Agriculture of the average yield of oats in England for the years 1910–1915, include the year 1912, when frit-fly attacks were exceptionally bad, and in which year it is estimated that the yield was reduced by no less than 6½ bushels per acre, the total loss being 12,126,198 bushels.

The plants attacked are rye, oats, barley, wheat, maize, and various grasses. In England, spring oats are chiefly attacked, though attacks

on winter oats, winter and spring wheat, barley, rye and grasses have been recorded. Infestation is most common (or most noticeable) on the young plants not far advanced in growth, but the larvae of the third brood will feed in the panicles of oats still hidden in the sheath; this also occurs, but more rarely in the British Isles, in the ears of barley, while only two records have been traced of larvae living in the ears of wheat. It has been stated that the females of the second brood will only oviposit on the blossoming oats, and failing these, on wild grasses. When able to choose between oats and barley, the flies prefer the oats, the same preference having been noticed in the case of oats and wheat. On the Continent the larvae appear to winter mainly in rye, but also in winter wheat and wild grasses; as regards England little is known, but the larvae have been found in winter wheat, winter oats, rye and in wild grasses, rye-grass, *Avena flavescens* and *Arrhenatherum avenaceum*. Winter-wheat has also been known to be attacked in the spring, the flies emerging at the end of June and beginning of July.

The majority of writers agree that there are three broods, though it has been thought that there may be four or even five in south Russia. It has been suggested that there may be a constant succession of broods dependent on the state of food-plants and the weather. Probably the broods more and more overlap as the season advances. The period of maximum emergence of the first brood of flies in England is from the middle of April to the middle of May, while that of the second brood is during July. The third brood has its maximum emergence in August and September, but in the case of wheat sown after rye-grass or Italian rye-grass the crop has been known to be attacked even when sown as late as November or early December, apparently indicating the possible migration of larvae from ploughed-in rye-grass to the young wheat plants.

In autumn and spring the eggs are laid on the leaves of the young plants, preferably on the under-side, or on the stem close to the ground. In the summer they may be laid on the sheaths enclosing the ears, on the panicles of oats, on the young grains of oats and barley, or on wild grasses. The maximum number of eggs laid in one day is 6; in moist air and a high temperature these may hatch in 3 days, but dry air will kill them. Normally only one larva is present in each shoot, but as many as ten have been found in a single plant. The spring and autumn larvae live in the young stem eating the tender central leaves and shoot, which is ultimately killed, the plant meanwhile producing side-shoots. The summer larvae live in the summit of the stem, feeding on the hidden ears or panicles, or in the stems of grasses. The spring and autumn larvae pupate under the sheath of the outer leaves, the summer ones among the leaves surrounding the hidden ear or panicle, or in the grain itself, or between the grain and the husk. The pupal stage may last 8–14 days, the length of time being governed by the amount of moisture, the drier the conditions the longer the period. Experiments have proved that flies were capable of getting through 7–9 inches of rammed wet earth upon emergence from pupae buried at that depth. Very varying accounts of the length of life of the adults have been given by various writers, that of the male being from 1 day to 1 month, that of the female from 2 weeks to 5 months.

In discussing the synonomy of this species it is pointed out that the variety of this insect that has been recorded under the name *pusilla* is *not* the true *O. pusilla* of Meigen. This variety has been recorded on the Continent as attacking only rye in the winter generation and only the panicles of oats in the summer one.

The parasites of the frit-fly include *Sigalphus caudatus, Pteromalus puparum, P. micans, Rhoptomeris wildhami, Trichomanus cristatus, Polyscytus oscinidis, Merisus intermedius, Semiotellus nigripes*, and *Miris dolobratus.*

It is the universal opinion that late-sown spring crops are most affected, the date of the beginning of the dangerous period being probably dependent on the weather. Spring corn sown before the end of March is usually not attacked; occasionally it may be safe to sow up to the middle of April on a good tilth, but after that date attack is very probable in infested districts. Reports of bad frit-fly attack on crops " after grass " are common both in this country and in Canada. It must be remembered that some of the reported attacks on wheat may have been due to *Hylemyia coarctata*, damage by which much resembles that of *O. frit.* Attention has also been called to the possibility of infested seeds acting as a source of infection.

The only remedies are early sowing and stimulation of early growth. The best time for sowing probably varies with the season, but crops sown early in March usually enjoy immunity from attack. Ammonium sulphate and sodium nitrate appear to be two of the best top-dressings for young oats, and it has been specially noted that sodium nitrate, applied as soon as the oats were through, gave better results in a dry season than ammonium sulphate applied when oats were drilled. Fields should be kept clean of grass, and grass borders round fields and grass edgings to field roads should be destroyed.

MORRIS (H. M.). **The Larval and Pupal Stages of *Scatopse notata*, L.**—*Ann. App. Biol., Cambridge*, v, no. 2, October 1918, pp. 102–108, 7 figs., 1 plate. [Received 14th December 1918.]

The larva and pupa of *Scatopse notata*, L., are here described from larvae obtained in Cheshire at the end of October 1917, in the decaying remains of a wasp's nest. The pupal stage was found to last about 14 days.

GREEN (E. E.). **A List of Coccidae affecting various Genera of Plants.**—*Ann. App. Biol., Cambridge*, v, no. 2, October 1918, pp. 143-156. [Received 14th December 1918.]

This paper forms the third part of the author's valuable list of Coccids and their food-plants [see this *Review*, Ser. A, v, p. 519 & vi, p. 281].

BEVAN (W.). **To Potato Growers' and Merchants.**—*Cyprus Agric. Jl., Nicosia*, xiv, no. 4, October 1918, pp. 85–86. [Received 13th December 1918.]

In several parts of Cyprus potatoes have been attacked by a moth, *Phthorimaea operculella* (*Lita solanella*), which lays its eggs in the eyes or buds of the tubers, into which the larvae burrow. It is a

difficult pest to deal with, and tubers attacked should at once be burned or buried at a depth of at least 2 feet. The growing plants are also liable to attack, the insect ovipositing on the leaves and the newly hatched larvae burrowing down the stem till the tuber is reached. No treatment can be applied at this stage and the only effective measure is of a preventive character such as is now imposed by an Order which prohibits the buying, selling or sowing of infested potatoes.

BEVAN (W.). **Annual Report, Director of Agriculture, Cyprus, for the Year 1917-18.**—*Nicosia*, 1918, 21 pp.

The chief pests dealt with on pages 11–13 of this report, during 1917–1918 were:—*Ceratitis capitata* (Mediterranean fruit-fly), which became much less numerous owing to the collection and burying of infested fruits. The campaign against *Zygaena ampelophaga* (vine sirividhi), which was begun in 1916, was renewed more effectively, vineyards belonging to 330 owners being sprayed under supervision, though a small amount of re-infestation occurred owing to late hatching. The moth is said to have been present for some 20 years and the loss of income due to it must have been considerable. Apple trees in certain villages were found to be suffering from ermine moth [*Hyponomeuta*] and the owners were induced to spray them. The campaign against *Cecidomyia ceratoniae* infesting carob trees, involving the removal of stunted fruits and first flowers, has been very successful. A new insect infesting carob trees has also been discovered, and is being investigated. *Cydia (Carpocapsa) pomonella* (codling moth) was dealt with by the daily collection and destruction of fallen infested fruits, especially apples, pears, quince and walnuts. The hay band system was found impracticable in most cases. The almond trees of one district were found to be badly attacked by *Eurytoma amygdali*. Spraying was carried out on melon plants for Aphids, on olive trees suffering from *Phloeotribus scarabaeoides* (*Scolytus oleae*), and on pomegranates attacked by mites, 8,000 of the latter trees being saved by this means, assisted by the weather and by parasites of the mites. *Scythris (Oecophora) temperatella* (sirividhi of wheat) an old-standing and troublesome pest was found to be on the increase.

BURT (B. C.). **Report on the Cawnpore Agricultural Station in the United Provinces, for the Year ending 30th June 1916.**—*Allahabad*, 1916, 41 pp. [Received 16th December 1918.]

In the entomological notes on pages 35–41 of this report it is stated that during the cotton-growing season open cotton flowers were attacked chiefly by *Pectinophora (Gelechia) gossypiella*, which appeared at the beginning of August, while *Earias fabia* predominated in the buds, appearing in July and boring in the terminal shoots and in the young bolls until September and again in the late bolls. The damage done by *P. gossypiella* is better estimated from the numbers found in flowers than from the bolls, as flowers attacked generally fail to set. It also attacks the seed in otherwise healthy kapas [seed-cotton] in October (when *Earias* is still mostly present in late immature bolls) and is found in large numbers hibernating in unginned kapas throughout the cold weather.

Bhindi [*Hibiscus esculentus*] was attacked by *Earias* to a much greater extent than cotton, practically all the caterpillars reared from

it being *E. fabia*; *E. insulana* did not appear till late in the season, and then in small numbers only. *Earias* was heavily parasitised by *Rhogas* in July, but this condition rapidly changed, probably owing to a wet season; the parasites recurred, however, at the end of September. There is little difference between the degree of parasitism of *Earias* by *Rhogas* in bhindi and country cotton, but in American cotton *Earias* was less attacked. It is often stated that American cotton is more susceptible to damage by bollworm than desi cotton, but in the year under report, as well as in previous years, the reverse has been the case, the damage, however, being more readily seen in American cotton owing to the habit of the plant and the large and conspicuous boll.

No parasites were bred from *P. gossypiella.*

Other cotton pests included *Sylepta derogata,* which appeared as usual chiefly on American cotton in August, but did no damage, being troublesome only on grown cotton under nets for plant breeding purposes, and being being easily controlled by handpicking. *Anomis* (*Cosmophila*) *erosa* also infested netted plants, but caused no damage in the fields. *Dysdercus cingulatus* increased rapidly at the beginning of November and it was found necessary to keep it down by handpicking. *Empoasca gossypii, Oxycarenus laetus,* and *Myllocerus maculosus* were also found in small numbers.

Phthorimaea operculella (potato moth) was again active in stored potatoes in one district and extended demonstrations of the sand storage method were given. This measure should however only be adopted when it is necessary to stop the ravages of a pest that would otherwise destroy practically the whole of the potatoes in the course of 5 months' storage. When the potato moth is absent, storing in open baskets gives much better results, as there is no overheating due to defective ventilation.

Chilo simplex appeared as usual in young sugar-cane in March and April, when damaged shoots were collected and destroyed. It also appeared in large numbers in August and September in juar [*Sorghum vulgare*]. Organised destruction of juar and sugar-cane stubbles over large areas would probably control the pest. *Scirpophaga* sp. was also found on sugar-cane in March and April. The sugar-cane leaf-hopper, *Pyrilla aberrans,* was found in large numbers in October. All stages, eggs, nymphs and adults were present, the eggs being parasitised by a Chalcid not yet identified.

Heliothis (*Chloridea*) *obsoleta* and *Phytometra* (*Plusia*) *nigrisigna* were both found on gram in March, but no serious damage was done. The former is parasitised by an Ichneumonid.

The bugs, *Anoplocnemis phasiana* and *Nezara viridula,* were found in small numbers on indigo in July.

Burt (B. C.). **Report on the Agricultural Experiment Stations in the Central Circle, United Provinces, for the Year ending 30th June 1917.**—*Allahabad,* 1918, 89 pp. [Received 16th December 1918.]

The entomological notes for the year are given on pp. 28–32 of this report.

In the earlier part of the season the attacks on American and desi cotton and bhindi [*Hibiscus esculentus*] by various bollworms followed the same course as in the previous year. *Earias* first appeared, boring

in the terminal shoots of young cotton. *Pectinophora gossypiella* predominated in early flowers and in damaged flowers throughout the season, these commonly failing to set bolls, but this species did not occur in bhindi. *Earias fabia* predominated in damaged bolls, *E. insulana* not occurring during the year.

During the first week in September 19·6 per cent. of *Earias* collected from American cotton, and 16·6 per cent. of those from desi cotton, were parasitised by *Rhogas*. No *Rhogas* emerged from the *Earias* collected from bhindi except from the last batch collected at the end of October, 5 per cent. of which were parasitised.

Parasitism to the extent of 20 per cent. was found in *P. gossypiella* collected in September, this being the first recorded instance at Cawnpore.

To determine the method of hibernation of various bollworms, 16 plants of desi cotton were enclosed under nets from 14th November to 14th March. There were then found 43 *P. gossypiella*, 1 hibernating on the ground, 5 in open bolls on the plant, and 37 in open bolls on the ground; two *Earias* were found actively feeding inside buds on the plant; three *Dysdercus cingulatus* were found on the plants, one immature; two pupae, identified as those of *Cirphis loreyi* and *Euxoa spinifera* were dug up from the ground around the plants. Two one-pound samples of stained seed-cotton from the last pickings, examined on 25th November and 11th December, yielded 330 and 293 live bollworms, 13 and 9 dead ones and one living pupa. There is every reason to believe that *P. gossypiella* is a more serious pest of cotton at Cawnpore than *Earias*, being carried over from one season to the next in cotton left standing in the field, in seed-cotton and in cotton seed. The only other cotton pest of any importance was *Sylepta derogata* (cotton leaf-roller), occurring chiefly on American cotton; this was easily controlled by hand-picking during the earlier stages.

The borer, *Chilo simplex*, appeared as usual in young sugar-cane in April-May and from July to November was found almost entirely in juar (*Sorghum vulgare*), which it seems to prefer to sugar-cane. From December to March it was found hibernating in juar stalks stored for cattle food, the moths emerging early in April. *Scirpophaga* sp. was found in sugar-cane throughout the year, no serious damage being done. It did not migrate to juar in July, but hibernated in sugar-cane.

Agrotis ypsilon was found in considerable numbers on potato and tobacco in March and April, *Laphygma exigua* being found in small numbers on potato, as well as *Monolepta signata* and *Myllocerus* eating potato leaves.

Storing potatoes in sand owing to the presence of *Phthorimaea operculella* (potato moth) was resorted to in one district, the sand being temporarily removed and bad tubers picked out once a month. Much better results were obtained by storing in sand on a bamboo platform than on the floor.

CRIDDLE (N.). **The Large Aspen Tortrix,** *Cacoecia conflictana*, **Walk.** —*Agric. Gaz. Canada, Ottawa*, v, no. 11, November 1918, pp. 1049–1051, 2 figs.

Instances of comparatively harmless insects suddenly developing into destructive pests are seen in the case of *Porosagrotis orthogonia*

(pale western cutworm) and *Tortrix* (*Cacoecia*) *conflictana*, Wlk. (large aspen tortrix).

In 1916 aspen poplars over a wide area in Manitoba were found to be infested by small Lepidopterous caterpillars, which first ate holes in the unfolding leaves and then curled them by means of silken webs; they migrate to another leaf when their food-supply is exhausted the trees being thus practically defoliated. Two species, remarkedly alike in habits, were concerned, viz.:—*Tortrix conflictana* and *Argyroploce duplex*, Wlsm.

The eggs, in masses of from 160–600, are attached to the upper surface of the leaves in the first half of June. The larvae emerge about 10th July and immediately crawl to the under-surface of the leaves in which they eat small holes. By about 24th July all have vanished to hibernate on the ground, reappearing in the spring and reascending the trees. Full-grown larvae, instead of curling a single leaf, usually spin 2 or 3 together. Pupation takes place about 10th July, almost a year from the time of hatching, the curled leaves being used for the purpose.

During the second year of this infestation the insects were attacked by several Hymenopterous parasites and by many birds, the numbers being appreciably diminished thereby. In the spring of 1918, however, hot weather in April induced both early foliage and an early awakening of the larvae. A subsequent change to almost winter weather killed the greater part of the newly opened leaves and caused a dearth in the food supply, killing off the young larvae and putting an end to the infestation.

Remedial measures for woodlands are not practicable at present, but ornamental trees may be sprayed to kill the young caterpillars towards the middle of July, or the trees may be banded with some adhesive material to prevent the larvae from ascending them after hibernation.

Robinson (E.). **Descriptions and Records of Philippine Coccidae.**—*Philippine Jl. Science, Manila*, xiii, Sec. D. no. 4, July 1918, pp. 145–147, 3 figs. [Received 12th December 1918.]

The Coccids dealt with in this paper are:—*Phenacoccus spinosus*, sp. n., on *Ficus nota*; *Pseudococcus virgatus*, Ckll., on *Hibiscus rosasinensis* and *Bridelia stipularis*; *Hemichionaspis aspidistrae*, Sign., on the mature fruit of *Areca catechu*, L.; *Aspidiotus cydoniae*, Comst., and *Pseudaonidia manilensis*, sp. n., on *Samanea saman*; *Chrysomphalus rossi*, Msk., on *Phalaenopsis* sp.; *Greeniella javanensis*, Green, on *Eugenia* sp.; *Lepidosaphes gloveri*, Pack., on mature fruits of *Areca catechu*; and *Cryptoparlatoria uberifera*, Lind., on *Artocarpus* and *Mallotus philippinensis*.

Coad (B. R.). **Recent Experimental Work on Poisoning Cotton-boll Weevils.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 731, 19th July 1918, 15 pp., 10 figs. [Received 12th December 1918.]

Innumerable attempts to control the Mexican cotton-boll weevil [*Anthonomus grandis*] by the use of poisons have been made, practically from the time of its first appearance; the results, however, have always been discouraging. This is attributed to the fact that the

weevil derives its food from deep punctures, thus ingesting very little of the poisoned external plant tissues. Studies on the boll weevil under cage conditions during 1913 and 1914 showed that water was essential to its continued existence, and from this fact was derived the idea of poisoning the water which the weevils would drink.

The first tests of this nature were begun in 1915 in typical delta territory normally subject to very heavy weevil injury owing to the prevailing great humidity and excessive rainfall. Three series of 5 one-acre plots were taken, the two end ones of each series being given 4, 5, and 6 applications of dry dust poison respectively. The results showed that every poisoned plot yielded more than the untreated controls, the most pronounced feature being the greater increase in yield with the larger number of poisonings. Thus with 4 applications a gain of about 15 per cent. was secured; with 5, this gain was increased to about 35 per cent., while 6 applications increased it to 70 per cent. As all applications were begun at the same time and the extra ones simply meant the continuation of the treatment until later in the season, the importance of late season applications seemed obvious.

In 1916 similar experiments were carried out, beginning with the first appearance of the weevils in June and lasting until about the 1st September, the results being quite as definite as those of 1915 and very plainly demonstrating the greater importance of late-season applications.

In 1917 it was intended to conduct an elaborate series of tests to study the comparative efficacy of different poisons, the time of day when application gave the best results, the most profitable season of application, the proper interval between applications, the requisite amount of poison per acre and many other similar questions. Unfortunately, however, the season was most remarkable for the slight amount of weevil damage and the experiments had to be given up. About the middle of August experiments on a large scale were rendered possible in an adjacent State, where late planting and adverse weather conditions had combined to produce an exceptionally heavy weevil infestation. It was too late to attempt to set a new crop by poisoning, but an effort was made to save the bolls then present on the plants. One application of poison was given, and 10 days later it was found that the number of punctured squares had been reduced from 86 per cent. to 36 per cent., thus showing poisoning to be a very profitable operation.

In the course of these experiments many different poisons were used and it was found that nearly all arsenicals were effective to a certain degree but that the best results could be obtained with either a di-hydrogen lead arsenate containing not less than 32 per cent. of arsenic pentoxide, or a calcium arsenate containing at least 42 per cent. of arsenic pentoxide; both of these gave an effective control, if properly used. It may also be possible to dilute these considerably with some cheap carrier such as lime, though this has not been definitely determined. The physical condition of the poison is fully as important as its chemical composition, the finer powder being more readily taken up by the dew and held in suspension for the weevils. Hence the most effective form of the above poisons has been powder of a density ranging from 80 to 160 cubic inches per pound.

The most effective season of application will probably be found to be at about the time when the weevils are doing their maximum injury to the crop and the cotton manifestly slackens in blooming, once a week probably constituting an effective application. Much more effective poisoning with dry dust can be conducted while the dew is on the plant, and it will probably be found advisable to poison as much as possible during the evening, night, and early morning, and to do so during the day only in case of emergency.

Hitherto the amount of poison needed for an application has depended on the requirements of the machinery used rather than on the amount necessary to dust the plants thoroughly. The experimental average of 5 lb. per acre is obviously excessive, and with improved machinery effective poisoning may be accomplished with a much smaller amount. The number of applications will of necessity vary with the size of the plot to be dusted, a single application over a large area being as effective as three on a small one, in consequence of the constant migration of further weevils into the latter.

The cost of treatment varies widely; in experimental work it has averaged about 4 shillings an acre for each application. With improved machinery and the use of carriers this can be much reduced, and a further economy may be effected by giving several applications to that part of a plantation near the hibernation quarters of the pest before the weevils have become sufficiently abundant to start movement, the remainder needing perhaps only a single application. A definite plan of procedure for the poisoning of weevils under all conditions is impossible at the present stage of the investigation and much more experimental work will be needed before such a plan can be proposed.

McAtee (W. L.). **Notes on Nova Scotian Eupteryid Leaf-hoppers including Descriptions of Two New Species.**—*Canadian Entomologist, London, Ont.*, l, no. 11, November 1918, pp. 360–361.

The new species here described are *Typhlocyba cymba*, and *Erythroneura ador* from specimens on elm.

Sasscer (E. R.) & Sanford (H. L.). **Effect of Hydrocyanic-acid Gas under Vacuum Conditions on Subterranean Larvae.**—*Jl. Agric. Research, Washington, D.C.*, xv, no. 3, 21st October 1918, pp. 133–136. [Received 18th December 1918.]

Under normal conditions from five to seven million ornamental plants are introduced into the United States annually with balls of earth round their roots, without the removal of which it is impossible satisfactorily to inspect and safeguard the plants. Since practical horticulturists strongly advise against this course, experiments have been made to test the fumigating power of hydrocyanic-acid gas under vacuum conditions. Larvae of *Agriotes mancus*, Say (wheat wireworm), *Allorrhina* (*Cotinus*) *nitida*, L. (green June beetle), *Lachnosterna* (white grub), and *Popillia japonica*, Newm., were exposed to the gas in potting soil, dry, moist, and soaked, in 3-inch flower pots, the larvae being from 1 to 3 inches from the surface of the soil. The chemicals used were sodium cyanide guaranteed to contain not less than 51 per

cent. of cyanogen, and commercial sulphuric acid. The cyanide was used in solution by dissolving 4 lb. sodium cyanide in 1 U.S. gal. water. The formula used was :—Sodium cyanide in solution 2½ oz., sulphuric acid 1 oz., water 1 oz.

Taken collectively the results show that the killing of 100 per cent. cannot be depended on where the larvae are in balls of earth round the roots of plants, if a dosage is used that will not injure the stock, especially in the case of moist and soaked soil. Since the effectiveness of hydrocyanic-acid gas under vacuum conditions is influenced by the water content of the soil, the death of 100 per cent. in soaked soil could not be obtained with dosages ranging from ½ oz. to 3 oz. per 100 cubic feet of space. By far the best results were obtained where a preliminary 15-inch vacuum was followed by an exposure of one or more hours under normal atmospheric conditions, 100 per cent. of the larvae of *Allorrhina nitida, Agriotes mancus, Popillia japonica* and *Lachnosterna* sp. being killed by this treatment. Of the various larvae used *Popillia japonica* was the most difficult to kill and *A. nitida* was the most susceptible.

With our present knowledge of vacuum fumigation with hydrocyanic-acid gas, a dosage exceeding 1 oz. of sodium cyanide per 100 cubic feet of space with an exposure of 1½ hours is not recommended for plants in foliage. Inasmuch as all larvae in soaked soil are not killed with dosages varying from ½ oz. to 3 oz. per 100 cubic feet of space, it follows that fumigation at the port of entry with a dosage that will not injure the plants cannot prevent the introduction and establishment of all subterranean pests.

Osborn (H.). **The Meadow Plant Bug,** ***Miris dolabratus.***—*Jl. Agric. Research, Washington, D.C.*, xv, no. 3, 21st October 1918, pp. 175-200, 5 figs., 1 plate. [Received 11th December 1918.]

Miris dolabratus, L. (meadow plant-bug), has been a conspicuous insect in timothy grass meadows in portions of the eastern United States during the past 40 years and now has a distribution as far west as Illinois and Minnesota and south in the Mississippi Valley into Kentucky. It is believed to be an introduced species, coming from England with timothy hay or other large-stemmed grass shipped for forage or packing some time between 1800 and 1825. It feeds upon cultivated grasses, especially timothy, orchard grass and meadow fescue, and when abundant must seriously affect the value of the crop. It is a dimorphic species, there being two forms of females, a long-winged and a short-winged form, the latter being far more plentiful.

It hibernates in the egg-stage; hatching occurs about 25th May to 10th June in Maine; the nymphs pass through five instars of about 6 or 7 days each, adults occurring from early July, mating and laying eggs from 10th July to 1st August. In the case of the short-winged forms this necessarily takes place in the fields where the females have developed. The eggs are laid in stems of grass or clover, being thrust through the wall of the stem and held by an expanded cap which is firmly contained by the walls of the stem; they are thus protected in the hollow of the stem and remain in this position for at least 8 or 9 months before hatching. Remedial measures should consist especially of rotation, with probably some advantage from burning, early cutting,

pasturing heavily in autumn, and possibly by mechanical devices for capturing the nymphs or adults. The spread of the insect should be prevented by care in the disposal of timothy hay moved to a distance. No hay from an infested district should be allowed to be scattered in or near meadows in localities where the insect is not already present. Natural enemies consist, so far as at present known, of spiders, a predaceous damsel bug (*Reduviolus ferus*), a Tachinid fly (*Phorantha occidentis*) and another undetermined species, as well as a fungus, *Entomophthora* sp.

JONES (T. H.). **Miscellaneous Truck-Crop Insects in Louisiana. 1. Insects injurious to the Globe Artichoke in Louisiana. 2. The Granulated Cutworm, an Important Enemy of Vegetable Crops in Louisiana. 3. Experiments in Controlling the Tomato Fruit-worm with Arsenicals.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 703, 20th November 1918, 19 pp., 5 figs, 5 plates.

The Aphids, *Myzus braggi*, Gill., and *Aphis rumicis*, L., are the insects that cause the most serious damage to the globe artichoke (*Cynara scolymus*) in Louisiana. *M. braggi* (artichoke aphis) occurs in large numbers on the under-side of the leaves. In fields where *Iridomyrmex humilis*, Mayr (Argentine ant) is present, this pest attends the Aphids. *A. rumicis* (bean aphis), while not so common on artichoke as *M. braggi*, is more difficult to control by spraying owing to the distortion of the leaves caused by its attack. Other plants infested by *M. braggi* are *Cirsium horridulum* (yellow thistle), a common weed in Louisiana, *C. arvense* (Canada thistle) on which it is found in Canada during the latter part of summer and early autumn, while the winter hosts are *Hippophaes rhamnoides* (Russian olive) and *Shepherdia arvensis*.

No internal parasite has been found attacking this Aphid, but it has many predaceous enemies, including the Syrphid flies, *Allograpta obliqua*, Say, and *Syrphus americanus*, Wied., the larvae and adults of the Coccinellid beetles, *Scymnus puncticollis*, Lec., *S. terminatus*, Say, *Hippodamia convergens*, Guér., and *Cycloneda sanguinea*, L., as well as the larvae of a Chrysopid and a Hemerobiid, both undetermined. Another Coccinellid, *Megilla maculata*, DeG., and the predaceous bug, *Triphleps insidiosus*, Say, have been taken on globe artichoke infested with *M. braggi*, and probably feed on this aphis, which is also attacked by a fungus, *Entomophthora fresenii*. At Baton Rouge *S. puncticollis* appears to be its most efficient enemy.

During 1917 both these Aphids were satisfactorily controlled by spraying with 1 part by weight of nicotine solution (containing 40 per cent. of nicotine sulphate) to 1,000 parts of water, with laundry soap (standard, non-caustic type) added at the rate of 1 lb. to 25 U.S. gals. water. The plants were sprayed 7 times between 31st January and 26th May inclusive, more frequently than would have been necessary had not the presence of the Argentine ant as well as of unsprayed rows acted as a source of reinfestation. Pickings of edible heads from 11th May to 29th June showed an average of nearly 5 heads from each sprayed plant, and of 1 from each unsprayed plant, while the difference in growth of the plants was very noticeable. Spraying should be begun while the plants are quite young and the Aphids few, partly

on account of the injury due to *A. rumicis*, and also to prevent damage and economise in time and spray material. A spray mixture that has given good results consists of tobacco extract containing 40 per cent. of nicotine sulphate 8 oz., fish-oil soap 3 lb., water 50 U.S. gals., the mixture containing 1 part nicotine sulphate to 800 parts water.

Other insects attacking the globe artichoke in Louisiana are:—a bug, *Leptoglossus phyllopus*, L., the normal food-plant of which is the yellow thistle, the larvae of *Heliothis* (*Chloridea*) *obsoleta*, F. (corn ear worm), which bore into the edible heads, the plant-bugs, *Thyreocoris pulicarius* Germ., and *Nezara viridula*, L., and a Scarabaeid beetle, *Euphoria sepulchralis*, F. Cutworms, especially *Feltia annexa*, Treits., and *Agrotis ypsilon*, Rott., cause some injury, especially during the cooler months of the year.

The larvae of two Agromyzid flies, *Agromyza platyptera*, var. *jucunda*, Wulp, and an unidentified species have been found mining in the leaves, and a Membracid, *Entylia sinuata*, F., also breeds on them. The foliage is also fed on to some extent by other insects, including *Phytometra* (*Autographa*) *brassicae*, Riley (cabbage looper) and the adult of *Diabrotica duodecimpunctata*, Ol. (southern corn root-worm).

Feltia annexa, Treits. (granulated cutworm) is the principal cutworm attacking vegetables in Louisiana, other species being *Agrotis ypsilon*, Rott., and *Feltia malefida*, Gn. Practically all vegetable crops are attacked. In the insectary eggs were deposited singly at night, the number laid by individuals during the season varying from 5 to 1,106. The larvae, which feed at night, hiding by day in the soil at the base of the plant, have been taken during all months except March, May and September. There are 5 or 6 generations in the year, and at times these overlap so that all stages are present simultaneously. The length of time occupied by the combined egg, larval and pupal stages depends on the temperature, the minimum recorded being 38 days in July and August.

Natural enemies include the Tachinid, *Linnaemyia comta*, Fall., and the Ichneumonid, *Henicospilus purgatus*, Say, both reared from larvae; while *Sarcophaga helicis*, Towns., which issued from a rearing jar containing larvae, may have been parasitic on them. Dead larvae infested with the fungus, *Entomophthora virescens*, have also been found in rearing cages.

The best methods of control are by the use of poison-baits, and by spraying the plants with 2 lb. powdered lead arsenate to 50 U.S. gals. water, with 2 lb. yellow laundry soap added. A poisoned bait which gave good results was composed of bran 10 lb., molasses 1 U.S. quart, Paris green ½ lb., water 7 U.S. quarts, and the juice and finely chopped rind and pulp of 2 oranges. A mixture of 20 lb. bran, 2 lb. powdered lead arsenate, ½ U.S. gal. molasses and about 14 U.S. quarts of water, has also given good results in the field.

In the last section details are given of spraying and dusting experiments conducted during 1916 and 1917 against *Heliothis obsoleta*, F. (tomato fruit-worm). The sprays were applied by means of small compressed-air sprayers, the plants being treated 8 times for the spring crop and 7 times for the autumn one of 1916, and 5 times in the spring of 1917. For dusting a specially prepared, light, finely powdered lead arsenate was applied the same number of times by means of a dust gun. The very varied results of two years' work, however, show that

none of these treatments can be considered to have reduced the injury profitably, though lead arsenate, applied undiluted as a dust, gave the best results.

ILLINGWORTH (J. F.). **Tachinid Parasite of the Cane Borer Weevil.**—*Queensland Agric. Jl., Brisbane*, x, no. 3, September 1918, pp. 149–150. [Received 20th December 1918.]

The author records the obtaining of an abundant supply of the Tachinid parasite [*Ceromasia sphenophori*] of the cane borer weevil [*Rhabdocnemis obscurus*] from a field which was an old nursery of seedling canes, and where no trash had been burned, thus affording ideal conditions for the propagation of the borer. The old breeding cages from which the parasites were liberated in 1910 were located alongside this field.

All the sugar-cane in the district is burned before cutting, which may account for the scarcity of the borers, the fires destroying a large percentage of those that are left in the discarded canes, or the grubs succumbing later to the action of the sun upon the exposed stalks. Further, fully half of the sugar-cane grown is of a variety so hard that the borers are not attracted to it.

The natural enemies of the Tachinid parasites were very scarce in the district, the exotic ant, *Pheidole megacephala*, being present only in moderate numbers and jumping spiders being practically absent.

CUSHMAN (R. A.). **Notes on the Cocoon-spinning Habits of Two Species of Braconids (Hym.).**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 7, October 1918, pp. 133–136. [Received 30th December 1918.]

This paper deals with the method of construction of the cocoons of *Apanteles congregatus*, Say, parasitising *Ceratomia catalpae*, Boisd., and of *Meteorus hyphantriae*, Riley, infesting *Hyphantria cunea*, Drury (fall webworm).

AINSLIE (C. N.). **A Note on the Economic Importance of *Samia cecropia* (Lep.).**—*Proc. Entom. Soc. Washington, D.C.*, xx, no. 7, October 1918, pp. 150–152. [Received 30th December 1918.]

The larvae of *Samia cecropia* may occur in large numbers without being noticed, in spite of their size, unless they happen to concentrate on a single tree or group of trees. An example of this on some box elder trees is given. An outbreak of this moth in a city of North Dakota in 1917 that threatened the trees of the city was dealt with by paying for the collection of cocoons, nearly 20,000 being destroyed in a single year; a large percentage of these were found to be parasitised.

GOSSARD (H. A.). **The Wheat-insect Survey of 1918.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, iii, no. 9, September 1918, pp. 259–266, 2 figs. [Received 30th December 1918.]

The survey of wheat conditions for the season of 1918 in 73 of the 88 counties of Ohio, showed that the most important pest of wheat was the joint-worm [*Isosoma*], which reduced the yield in 1918 by at

least 10 per cent., representing a monetary loss of about £1,600,000. A marked reduction in the damage done is expected in 1919, as 90 per cent. of the joint-worms in the north-western counties were attacked by parasites. Two species occur in the western and eastern parts of the State respectively, the latter, however, never having caused disastrous damage.

The Hessian fly [*Mayetiola destructor*] was noticeable nearly everywhere, but only in a few of the north-western counties did it reach an average infestation of 4 or 5 per cent.

Chinch bugs [*Blissus leucopterus*] occurred in small numbers over most of the western part of the State, and in some places were injurious to maize following the wheat harvest.

The wheat midge [*Contarinia tritici*] occurred in nearly every field in the State, the total damage, however, being probably not more than 1 per cent. The females oviposit in May in the glumes of the wheat grains, the larvae feeding on the young grains and causing them to shrivel. When full-grown they descend to the ground in which they make small cells about half an inch below the surface, where they hibernate. Bearded wheats and rye generally suffer less from this pest than the smooth varieties of wheat.

These insect pests may be guarded against by early sowing, by ploughing under the stubble to a depth of 7 or 8 inches, by the use of fertilisers, such as barnyard manure and acid phosphate, of which it is advisable to use 200 to 300 lb. to the acre, and by the formation of a good firm seed-bed, best secured by disking and harrowing several times after deep ploughing.

BERGER (E. W.). **Cabbage Worms.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, iii, no. 1, October 1918, p. 16. [Received 30th December 1918.]

The standard remedies for cabbage worms [*Pieris*] are arsenical poisons. These are best applied as a spray, but may be used in dust form mixed with one to several parts of hydrated lime or other dust when the plants are wet. The following formulae are recommended:—(1) Paris green 1 lb., soap 5 or 6 lb., water 50 U.S. gals. (2) Lead arsenate (powdered) 2 lb., soap 5 or 6 lb., water 50 U.S. gals. (3) Zinc arsenite (powdered) 2 lb., soap 5 or 6 lb., water 50 U.S. gals. A remedy that may be used on cabbages that have formed heads consists in dusting the plants with air-slaked lime with which a little salt has been thoroughly mixed, at the rate of a handful of salt to 2 gals. lime. Other measures that are recommended are hand-picking in small patches or home gardens, and sprinkling with hot water at a temperature of 130° F., the latter being specially efficacious against the young caterpillars.

BRAGDON (K. E.). **Quarantine Department.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, iii, no. 1, October 1918, pp. 18–19. [Received 30th December 1918.]

During the quarter ending 30th September 1918 some of the principal pests intercepted from foreign countries were:—*Aspidiotus* sp. on *Globularia*, Glover's scale [*Lepidosaphes gloveri*] and chaff scale [*Parlatoria pergandei*] on citrus from Spain; Aspidistra scale

[*Hemichionaspis aspidistrae*], *Bephrata cubensis*, and hemispherical scale [*Saissetia hemisphaerica*] on sour sop, *Chaetopsis debilis*, Lw., *Hippelates pallidus*, Lw., *Lonchaea polita*, Say, long-tailed mealy-bug [*Pseudococcus adonidum*], and soft scale on beet, mango fruit-fly [*Dacus ferrugineus*] on guava, purple scale [*Lepidosaphes beckii*] on citrus, and Tyroglyphids on cassava from Cuba; a Cerambycid beetle on citrus from Jamaica; and purple scale [*Lepidosaphes beckii*] on citrus from Honduras.

MILLER (D.). **Control of New-Zealand-Flax Grubs. Investigations into Parasites.**—*New Zealand Jl. Agric., Wellington*, xv, no. 6, 20th December 1917, pp. 303–306, 6 figs.

A small Ichneumonid has been found parasitising the young larvae of *Xanthorhoe praefectata* (New Zealand flax-grub) to the extent of 30 per cent. in the flax-growing district south of the Shannon-Foxton line, the flax there being comparatively free from the attacks of the grub, while in the swamp district north of that line no parasitised larvae have been found. The mature parasites emerge simultaneously with the hatching of the first spring brood of larvae. Another larger Ichneumonid occasionally attacks the larvae of *X. praefectata*; but unlike the former it pupates in the pupae and not in the larvae of the host. This species, however, does not seem to confine itself to *X. praefectata* sufficiently to exert much control.

Another flax-grub, *Melanchra steropastis*, which attacks the edge of the leaf and not the lower surface, is attacked by a fly, *Phorocera marginata*, which, however, also parasitises several other species of insect larvae.

MILLER (D.). **The New Zealand Flax-grub. Progress of the Investigation.**—*New Zealand Jl. Agric., Wellington*, xvii, no. 4, 21st October 1918, pp. 209–215, 2 figs.

This paper supplements previous ones already noticed [see this *Review*, Ser. A, v, p. 453 and 525] in suggesting artificial methods of controlling *Xanthorhoe praefectata* (New Zealand flax-moth). The most effective results by utilising excessive moisture are to be obtained at the time when the insect is pupating in the ground, since humidity is fatal to it just at the stage when pupal transformation occurs. The existence of more than one generation, however, places a difficulty in the way of this method, since the periods of pupation and larval activity overlap. There are, however, brief periods when, for the most part, both generations are pupating simultaneously, and when flooding should be most effective. Such periods are:—(1) from the latter part of July to the end of September, which would affect the pupae of the overlapping generation due to emerge in August and also those of the main generation pupating in August and Spetember; (2) from December to February, affecting the second brood of the overlapping generation pupating during December, and that of the main generation pupating during February. The use of excessive moisture as a means of control would involve the sinking of artesian wells and the cutting of a network of open drains, work that entails considerable cost both in initial outlay and upkeep.

On the other hand, control by means of insect enemies, though the discovery of such might entail considerable time and initial expenditure, would, when once established, carry on the work with only very little attention. Such enemies are the two Ichneumonids recorded in the previous paper, *Ichneumon* sp. and *Paniscus productus*, of which the former is by far the more important since it confines its attention to the larvae of *X. praefectata*, and also destroys them before they are half-developed and before much damage is done to the flax-leaf. This parasite, which was reported from one area but thought to be absent from a neighbouring one, has since been found to be present in both, but in the latter it is subject to the attack of a secondary parasite. *P. productus* on the other hand does not destroy the host-grub, but eventually emerges from the pupa after the maximum amount of damage has been done, and also, having several hosts, attacks only a small percentage of the larvae of *X. praefectata*.

DAVIDSON (J. H.). **Passion-fruit Culture.**—*New Zealand Jl. Agric., Wellington*, xvii, no. 4, 21st October 1918, pp. 232–234.

The chief insect enemies of the passion-vine (*Passiflora edulis*) in New Zealand are mealy bugs [*Pseudococcus*] and the vine hopper; badly infested plants can only be dealt with by fumigation with hydrocyanic gas. The plants, however, are not worth this expense and it is better to uproot and burn them.

WEBSTER (R. L.). **Common Garden Insects.**—*Iowa Agric. Expt. Sta., Entom. Sect., Ames*, Circ. no. 44, February 1918, 8 pp., 9 figs. [Received 30th December 1918.]

Several of the commoner garden insects, with descriptions of the methods recommended for their control, are dealt with, including:—cutworms, *Diabrotica vittata*, F. (striped cucumber beetle), *Pieris rapae*, L. (cabbage worm), *Papaipema nebris* (*nitela*, Gn.) (stalk borer), *Leptinotarsa decemlineata*, Say (colorado potato beetle), *Mellitia satyriniformis*, Hbn. (squash borer), blister beetles and grasshoppers.

Keep Insecticides from Freezing.— *Wkly. Press Bull. Pennsylvania Dept. Agric., Harrisburg*, iii, no. 49, 12th December 1918.

It is important to protect lead arsenate in the form of paste from both freezing and drying, as it then becomes so granular that it has to be re-ground before it can be used successfully as an insecticide. The powdered form is more convenient in this respect, as these precautions are unnecessary in its case. When lime-sulphur freezes, there is a change in it indicated by the deposition of a sediment and the presence of crystals at the bottom of the barrel, and resulting in the waste of the liquid.

DEUTROM (H. A.). **Cultivation of the Robusta Types of Coffee. Department of Agriculture, Ceylon, Leaflet no. 10.**—*Trop. Agriculturist, Peradeniya*, li, no. 4, October 1918, pp. 218–224, 2 plates.

The two chief insect enemies of the coffee plant in Ceylon are: *Coccus viridis*, Gr. (green bug) on young stems and foliage, which

may be controlled by introducing the fungus, *Cephalosporium lecanii*, leaves bearing infected scales being pinned on the branches of the trees, or by spraying with kerosene emulsion prepared by dissolving ½ lb. laundry soap or fish-oil soap in 1 gal. boiling water, 2 gal. kerosene being added to the hot liquid; and *Zeuzera coffeae*, Nietn., (coffee borer), the caterpillar of which begins boring in young twigs, moving on to stouter branches as it grows. It can be held in check by cutting out and burning infested branches or by passing a sharp wire into the tunnels.

GURNEY (W. B.). **The Insect Pests of Maize.**—*Agric. Gaz. N.S.W., Sydney*, xxix, no. 9, 2nd September 1918, pp. 641–650, 11 figs.

Some 25 species of insects have so far been recorded from New South Wales as attacking maize in the field, as well as the cobs and shelled grain in store. Among these are two species of moth larvae now recorded for the first time as attacking maize in New South Wales. These are the native species of sugar-cane boring moth (*Phragmatiphila* (*Nonagria*) *truncata*, Wlk.) which bores in the stem, and *Pyroderces* (*Batrachedra*) *rileyi*, Wlsm. (pink corn-worm), which is common on the ears, attacking the grain and top of the ear. It also attacks the ears in store, but is not serious in shelled and bagged grain. The damage done by it is not at present so extensive as is the case in some of the southern United States of America. No remedies against it are practicable except harvesting the cobs at the earliest opportunity and then fumigating in store. This is best done by removing and destroying the husks and then placing the cobs or shelled grain in a tightly-closed bin and treating with carbon bisulphide at the rate of 4 to 6 lb. per 1,000 cubic feet of space, or 1 to 2 lb. to 100 bushels of grain. Fumigation to be effective must be done at a temperature above 70° F.

From March to June 1918, the ear worm (*Heliothis obsoleta*, F.), infesting the cob, and the army-worm (*Cirphis unipuncta*, Haw.), attacking the foliage and cobs, were much in evidence in the field, infestations of the former affecting 28 per cent., and of the latter 86 per cent. of the crop. The caterpillar of *C. unipuncta* eats the foliage, sheath and silk of maize, in the case of young plants stunting the growth or even destroying the plants. Probably a native of America, it is now established as a pest in Australia, Europe and Asia. The eggs, to the number of 700 from a single female, are laid in rows against the bases of the leaf-blades and hatch in 8 to 10 days, the larvae reaching maturity in 3 or 4 weeks. They then pupate in the soil, an inch or two below the surface, the pupal stage lasting about 2 weeks in summer. It is probable that some of the moths hibernate, and some of the partly grown larvae, as well as late pupae, may also hibernate in the soil. Remedial measures include the ploughing and cultivation of the soil in winter to expose the pupae to birds, predaceous insects and the weather. Infested patches of rank grass and weeds near the fields should either be cut down and burnt over in early spring, or sprayed with 1 lb. Paris green or 2 lb. lead arsenate to 50 gals. water, stock being kept away from the sprayed patches. When the caterpillars are moving in masses in a definite direction a steep furrow may be cut in front of them into which they fall, being then killed by a log dragged along the furrow or by spraying with oil, soap and

water emulsion. The outer edge of a crop not intended for forage may be sprayed with the above Paris green or lead arsenate mixture, but with 2 lb. slaked lime added to prevent scorching. If the pest has spread throughout a crop it may be successfully dealt with by the use of poisoned bait, 1 lb. Paris green to 16 lb. bran with the addition of a little salt. Another formula not yet tested is 1 lb. Paris green or 9 oz. white arsenic to 50 lb. bran, and the juice of 6 oranges or lemons, made into a stiff mash with molasses.

Other insects attacking the cob are:—*Dichocrocis* (*Conogethes*) *punctiferalis*, Gn. (yellow peach or maize moth grub), a species native to the north coast of Australia and probably Queensland, which is common in the field, damaging the cob core, grain and silk, and occasionally boring in the stem, also attacking green peaches and sometimes sorghum heads. *Aphis maidis* (green corn-aphis) and a mealy-bug, *Dactylopius* sp., suck the sap of the leaves, stem and cob-sheaths.

The following insects, though also attacking the ears in the field, are most destructive to stored grain,—*Calandra oryzae*, L. (grain weevil), *Sitotroga cerealella*, Oliv. (Angoumois grain moth), *Tribolium castaneum* (*ferrugineum*) (red flour beetle), *Gnathocerus* (*Echocerus*) *cornutus*, F. (broad-horned flour beetle), *Rhizopertha dominica*, F. (lesser grain borer), *Silvanus surinamensis*, L. (saw-toothed grain beetle), *Laemophloeus* sp. (flat grain beetle), *Tenebrio molitor*, L. (meal-worm), *Tenebroides mauritanicus*, L., *Carpophilus hemipterus*, L., *Typhaea fumata*, L., and mites.

The leaves are attacked by a beetle, *Monolepta rosae*, Blackb., which also injures the silk of young cobs, probably preventing fertilisation, cutworms, *Nysius vinitor*, Berg. (Rutherglen bug) and various grasshoppers.

The roots or seedling corn in the soil are attacked by Elaterid larvae (wireworms), Scarabaeid larvae (white grubs), *Clirina* sp. (slender seed-corn beetle) and *Pentodon australe*, Blackb. (underground maize beetle).

So serious is the damage by weevils and grain moths to ripe maize during summer, that in the north coast districts the earlier crop, which ripens from January to April, is usually marketed at once to avoid loss. During the colder months from May to August, maize for convenience is often left standing or stored in the husks, or shelled and stored. In August damage by the pests begins again and increases, and preventive measures such as fumigation, and the cleaning up and destruction of infested grain or waste should be adopted.

Agricultural Experiments.—*Jamaica Dept. Agric. Ann. Rept. for Year ended 31st March 1918, Kingston*, 1918, pp. 14–18.

Banana suckers infested with *Cosmopolites sordidus* Germ. (banana borer) can be freed from all stages of the weevil without damaging the plant, by submerging them in water for 48 hours, owing to the fact that the weevil has so high a specific gravity that it immediately sinks and drowns. The weevils cannot be destroyed by fumigation with carbon bisulphide since this substance kills the plants, and constitutes in fact the cheapest and simplest way of destroying plants *in situ*.

The plan recommended by Sir Francis Watts and based on the assumption that the weevil breeds in the bulb only and not in the stem of the banana plant, consists in slicing the bulbs into pieces less than ¼ inch thick, drying these in the sun and leaving them on the surface of the field [see this *Review*, Ser. A, v, p. 435]. Though the weevils are unable to reproduce themselves in these slices, it has been found in practice that they hide underneath them. Consequently they form a most successful form of bait-trap, which in some plots has completely eliminated the pest.

As regards other measures in the field, burning is not recommended in any form, since the banana plant is most difficult to burn, requiring an enormous amount of oil if treated *in situ*, and taking many weeks to dry sufficiently if previously dug up and sliced, during which time it might act as a breeding-place. The use of carbon bisulphide on the plants chopped up, placed in pits and covered with 12 inches of earth is also unsatisfactory and is calculated to spread the pest by causing the adults at large to migrate in search of a fresh food supply. The keeping of fowls is advised on small holdings where the borer is prevalent, experiment having shown that *Metamasius sericeus* (brown weevil) and *C. sordidus* can both be completely controlled by this means. The view is expressed that good cultivation and clean management are all that is required to prevent this pest from exerting any injurious effect on commercial bananas.

WASHBURN (F. L.). **Injurious Insects and Useful Birds.**—*Philadelphia & London*, J. B. Lippincott Co., 1918, 453 pp., 4 coloured plates, 414 figs. Price 7*s*. 6*d*. net.

This useful text-book, one of the series of Lippincott's Farm Manuals, represents the results of some twenty-one years of the author's work in economic entomology. It has been compiled to meet the needs of schools and agricultural colleges and does not aim at being highly technical but covers a wide field and is full of practical information and suggestions. It is intended also as a reference for farmers, fruit and vegetable growers, owners of gardens and householders, and as a guide in the campaign against injurious insects. The various chapters deal with losses due to insects and farm practices to reduce these, external structure of insects, insecticides and spraying and fumigation. Insects are dealt with under the heading of the crops they injure. Other chapters are devoted to insects affecting man and the household, stock and poultry. Beneficial insects are dealt with and the relation of birds to agriculture is discussed at length. The numerous illustrations in the text are clear and helpful, and each chapter is supplied with a set of questions on the subject matter.

PANTANELLI (E.). **Esperienze ed Osservazioni sui principali Sistemi di Lotta contro le Cavalette.** [Experiments and Observations on the chief Methods of combating Locusts.]—*Le Stazioni Sperimentali Agrarie Italiane, Modena*, li, 1918, pp. 245–305. [Received 2nd December 1918.]

This report compares the chief methods of destroying locusts which the author has tested in the provinces of Rome and Caserta since 1916. Other comparable experiments made in Italy are those of Lunardoni

[see this Review, Ser. A. iii, p. 497]. It is stated that *Coccobacillus acridiorum* does not cause sufficient mortality among *Dociostaurus maroccanus* to be effective. The collection of egg-masses is a cheap method where labour is abundant and there are more than 100 masses per 11 square feet; it has, however, the disadvantage of destroying the pasture. Collection of the locusts themselves is a primitive and unsatisfactory method. Spraying a tar-oil emulsion destroys about 50 per cent. of the locusts, but is costly. Spraying with sodium arsenite is a highly useful and advisable measure, but land so sprayed must not be used for pasture until rain has fallen. An even better method is a poison-bait of bran and sodium arsenite, and this is the measure recommended for land that is not cultivated. In the case of cultivated land ploughing, followed by the sowing of winter cereals, is the best procedure.

VOGLINO (P.). **La Ragna o Ruga dei Meli, *Hyponomeuta malinellus*, Zell.** [The Apple Caterpillar, *H. malinellus*, Zell.]—*R. Osservatorio di Fitopatologia, Turin*, 1918, Foglio d'Istruzione no. 8, 4 pp., 1 fig. [Received 2nd December 1918.]

No new information is contained in this popular leaflet.

DE STEFANI (T.). **Il Verme dei Frutti del Pistacchio.** [The Pistachio Fruit Worm.]—*R. Osservatorio di Fitopatologia, Palermo*, 1918, 33 pp., 19 figs. [Received 2nd December 1918.]

The pistachio is a plant of considerable economic importance in Sicily. *Pistacia vera* is attacked by the Aphids, *Tetraneura utricularia*, Pass., *T. semilunaria*, Pass., and *T. derbesi*, Buckt., while *Pistacia Terebinthus* [terebinth] commonly, though erroneously, believed to be the male plant and used to fertilise *P. vera*, is infested in addition by *T. cornicularia*, Pass., *T. follicularia*, Pass., and *T. follicularia* var. *initialis*, Dest. Both plants are attacked by the Acarids, *Eriophyes stefanii*, Nal., and *E. pistaciae*, Nal. This last may prove very injurious if the malformation of the flower-buds reaches a point where pollination is prevented; all the other species are practically harmless. Both *P. vera* and *P. terebinthus* have a dangerous enemy in the Chalcid, *Megastigmus* (*Trogocarpus*) *balestrerii*, which attacks the kernel and has destroyed half the crop in some plantations. *M. balestrerii* has one annual generation in two periods. The first, from the end of August to mid-September, may be held to be abnormal and due to the prolonged summer heat hastening all stages from egg to adult. The second period takes place in the following year from the end of June to early August. This is the normal generation and is descended from larvae that have (in the preceding year) experienced the fall of temperature in September and then remained in a state of hibernation until the following May. The resultant normal adults find the young pistachio fruits in June and July in a suitable state for oviposition, whereas the abnormal adults in September are unable to deposit their eggs in the fruit owing to its hardness at that season. Even should eggs be deposited, the larvae will generally be unable to transform into adults before the cool weather begins in September and they will therefore merge into the normal generation. The danger period for

pistachio fruits is therefore June and July, and the infestation is caused by adults from the preceding year's larvae. A brief description is given of all stages. The natural food-plant of *M. balestrerii* seems to be *P. terebinthus*, and this is confirmed by the fact that most of its parasites are found in individuals on this plant, only few being found in individuals on *P. vera*. It would appear that those of the parasites that deposit their eggs on the host are unable to reach *M. balestrerii* within the larger fruit of *P. vera*, as their ovipositors are not long enough. This fact explains the increase of the pest. The parasites of *M. balestrerii* will be described in another paper. Infested fruit may be detected by throwing it into water, in which the sound fruit will sink. All infested fruit, including fallen fruit, must be burnt. Collection must not be limited to *Pistacia vera*, but must be carried out for *P. terebinthus* as well. In the case of the latter a simple means of attaining this object is the destruction of the female blossoms in April and May, not only those in the plantations, but plants in the neighbourhood being thus dealt with. Successful examples of this method are described; it appears to provide an effective remedy.

LEGISLATION.

Orders nos. 372, 373, 400, 401, 427, 429, 430 & 479 of His Excellency the High Commissioner. The Diseases of Plants Prevention Law, 1893.—*Cyprus Agric. Jl., Nicosia*, xiv, no. 4, October 1918, pp. 76–79.

By these proclamations it is ordered that the following provisions shall have effect in respect to the pests dealt with:—Within any area declared to be infected with the sirividhi of wheat (*Scythris temperatella*), owners shall burn the stubble after the harvest and shall plough it to a depth of at least four inches. Both operations should be carried out as soon as possible after harvest, and in any case the burning shall have been completed not later than the 1st September 1918, and the ploughing not later than the 15th February 1919.

Within any area declared to be infested with the scale, *Chrysomphalus* (*Aspidiotus*) *aurantii*, the owner of all kinds of citrus trees shall, between 1st September and 31st October 1918, apply to all parts of such trees a solution of lime-sulphur in the proportion of $1\frac{1}{2}$ parts sulphur and 1 part lime to every 100 parts water.

Within any area declared to be infested with potato rot or with the moth, *Phthorimaea operculella* (*Lita solanella*), all infested potatoes shall be buried in the ground and covered with at least two feet of soil. It is also prohibited within such area to sell or buy any potatoes so attacked.

Within any area declared to be infested with *Dacus oleae* (olive fly), the owner of olive trees shall, between 1st September and 31st October 1918, daily collect all fallen olives, and shall either bury them in the ground mixed with lime in specified proportions, or shall forthwith press them to obtain the oil.

Each of these proclamations is accompanied by a declaration defining the areas infested with the respective pests.

MARRAS (F. M.). **Lotta contro le Cavallette mediante il** ***Coccobacillus acridiorum.*** [Anti-Locust Work with *Coccobacillus acridiorum.*] —*Ministero per l'Agricoltura, Rome,* 1918, 1 p. [Received 2nd December 1918.]

The work recorded here was begun on 19th May 1917 and the results proved that *C. acridiorum,* when its virulence is increased, is able to destroy small foci of infestation and to kill large numbers of mature locusts. This biological method is advantageous if carried out in time and with proper means. It must be followed by mechanical measures which will destroy the locusts that have escaped infection.

AULLÓ (M.). **Reseña de los Trabajos verificados par la Comisión de la Fauna forestal Española durante el Año de 1915.** [A Review of the Work of the Spanish Forestal Fauna Commission during 1915.] —*Bol. Soc. Entom. España, Saragossa,* i, no. 8, November 1918, pp. 163–171, 2 plates.

At the beginning of May an investigation was made of an outbreak of *Dendrolimus pini,* L., which threatened to destroy some pine woods in Valencia. This moth, hitherto of rare occurrence in Spain, began to appear on the wing at the beginning of May and was abundant until the end of June (some two months earlier than in other countries). The adults continued to appear in small numbers until September, when they again became abundant, although less numerous than in May and June, a few individuals continuing to appear as late as mid-January. Instead of the trunks of pines being chosen for oviposition, as is usually the case, the branches and twigs or foliage were preferred, the eggs being laid, not in masses of 20 to 50 as in other countries, but in groups of generally less than 20, which increases the difficulty of destroying them. During these investigations a curious habit of the caterpillars of this moth was observed. If a light tap is given to the lower part of the trunk of large trees or to the branches close to their base, the larvae that are scattered about the crown of the tree descend the trunk within five minutes to the spot where the tree was struck. This greatly facilitates hand-collection, though if too strong a blow is given to the tree, the larvae will not react to it.

The larvae may be controlled in four stages:—when they are in the branches; when, having defoliated the pines, they migrate in search of other food-plants; while hibernating; and when, after hibernation, they re-ascend the pines. While in the branches the larvae can be collected by hand and the tree can be shaken to cause those that are out of reach to fall to the ground. To prevent migration, trenches may be dug about a foot deep in which the larvae can be destroyed or buried. As the side of the trench must be vertical, this method is not practicable in sandy soils and sticky bands must be resorted to.

The mixture used for banding consisted of 7 parts coal-tar, 5 parts black soap, 5 parts resin and 3 parts whale-oil. The coal-tar and resin are heated and well mixed, the soap and oil then being added and the whole stirred continually until cool. This mixture should remain viscid for two or three months, though it was found necessary on this occasion to renew the bands about every ten days. For controlling the larvae on the shoots a spray consisting of $3\frac{1}{3}$ lb. sodium arsenate to 100 gals. water has been found successful.

(C545) Wt.P2/137. 1,500. 3.19. B.&F.Ltd. Gp.11/3.

This practice is also recommended for *Cnethocampa pityocampa*, Schiff., the young larvae being found dead in their nests after the trees have been sprayed. The theory advanced in 1914 was confirmed during these observations, that pines infested by *Dioryctria* spp. were those that had previously been attacked by the fungus *Peridermium pini corticola*, or that grew by the roadside and had damaged branches, in the axils of which the larvae were found, as well as in tumours produced by *Bacillus pini*. Damage caused by *Dioryctria* spp. is generally found in the trunks of young pines or in the branches of older trees, at various heights. Control of these moths has been attempted by scraping away the resinous excrescences to expose the galleries and then treating them with coal-tar. They generally attack isolated pines, rather than those growing thickly together. Their life-cycle requires investigation. Caterpillars of various sizes have been found at the end of July, and it seems probable that adults appear not only in June and September but also during the intervening months and sometimes in May and October, a second hibernation also being possible.

Among other injurious insects studied during the year are the Coleoptera, *Brachyderes suturalis*, Gr., on pines; *Chalcophora mariana*, L., on evergreen pines; *Galeruca calmariensis*, L., on elms; *Hylastes ater*, Er., and *Myelophilus piniperda*, L., in pines; *Melasoma* (*Lina*) *populi*, L., on Canadian poplar; *Phyllodecta* (*Phratora*) *vitellinae*, L., on poplars; and *Pogonochaerus fascicularis*, Panz., on branches of silver pine. Hymenopterous pests included *Lophyrus rufus*, Ratz., on evergreen pines, and *Sirex juvencus*, L., in black pine. Lepidoptera included *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*), on elms; *Rhyacionia* (*Tortrix*) *buoliana*, Schiff., and *R.* (*T.*) *duplana*, Hbn., on pines; and *T. viridana*, L., on oaks. *R. buoliana* is of common occurrence in Spain as compared with *R. duplana*; the former appears in June and July and hibernates as a larva, the latter appears in March and hibernates in the pupal stage. The Aphid, *Eriosoma* (*Schizoneura*) *lanuginosum*, Hausm., was observed on elms in Granada.

Nouveaux Renseignements sur l'Habitat du *Lecanium persicae*, F. (Coccidae). [New Information about the Habitat of *Lecanium persicae*.] — *Bull. Soc. Entom. France, Paris*, 1918, no. 15, 9th October 1918, p. 207.

The new food-plants of *Eulecanium* (*Lecanium*) *persicae* here recorded are:- *Euonymus japonicus*, *E. pulchellus*, *Ampelopsis* sp. and *Wistaria sinensis*.

FEYTAUD (J.). **Eudémis et Cochylis. Recherches sur les Pièges-appâts.** [*Polychrosis botrana* and *Clysia ambiguella*. Experiments with Bait-traps.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvii, nos. 11–12, November-December 1918, pp. 113–119, 1 fig.

The efficiency of bait-traps for reducing the numbers of *Polychrosis botrana* and *Clysia ambiguella* depends on the time when they are used. Both these moths being protandrous, it follows that at the

beginning of a flight the males predominate, the females appearing after about a week and rapidly increasing in numbers, till at the time of full flight and during its decline, the females are in the majority. The best time for setting the traps is therefore on the first appearance of the females before they have oviposited, the period of usefulness lasting only 15-20 days for each flight. After this time the presence of the traps is not only useless, but actually harmful, since they then destroy predaceous and other beneficial insects.

NEWSTEAD (R.) & DUVALL (H. M.). **Bionomic, Morphological and Economic Report on the Acarids of Stored Grain and Flour.**—*Reports of the Grain Pests (War) Committee of the Royal Society, London*, 1918, no. 2, 48 pp., 11 plates. [Received 18th December 1918.]

This report describes important work on grain Acarids that has been carried out in Liverpool, where grain can be inspected in ship, granary and mill, while research has been undertaken in the laboratory of the University. The harmful species that have been found infesting grain and flour include the Tyroglyphid mites, *Tyroglyphus* (*Aleurobius*) *farinae*, DeG., *Glyciphagus cadaverum*, Schr., and *Chortoglyphus arcuatus*, Troup., the last being exceedingly rare. *Tyroglyphus longior*, Gerv., was not found, and *T. siro*, L., was only once observed in wheat from an unknown source. *Cheyletus eruditus* is constantly associated with Tyroglyphids in grain and preys upon them, but its numbers are never great. A species of Gamasid also occurs very rarely. The life-histories of the various species were worked out in breeding-cells.

Tyroglyphus (*Aleurobius*) *farinae* is the only Acarid that has been found in flour and is undoubtedly the most serious and frequent of all Acarid pests of grain and flour. It is also a common pest in cheese [see this *Review*, Ser. A, v, p. 516]. The life-cycle of this mite was worked out in June and July at temperatures from 64° to 71° F. In captivity the female lays from 20 to 30 eggs, 3 or 4 being deposited each day. After an incubation period of 3 to 4 days the larva emerges, feeds and develops rapidly for 3 days and then becomes inert for 1 or 2, after which the larval skin splits dorsally and the nymph emerges. The nymphal stage lasts from 6 to 8 days, when transformation to the adult form occurs. Pairing takes place on the day of ecdysis or the day after, oviposition occurring 2 or 3 days later. The males generally die shortly after mating, though they may pair with several females. The life-cycle thus occupies 17 days in favourable conditions, but in the winter months was found to require 28 days, both the incubation and nymphal periods being prolonged. The attack is made on wheat grains by a small hole being bored in that portion of the epicarp which overlies the embryonic region. The Acarids then enter and devour first the embryo and its surrounding tissues and later the endosperm, until little is left but the hollow husk.

Glyciphagus cadaverum frequently occurs in wheat which contains *T. farinae*, but in smaller numbers. It does not seem to attack sound wheat but lives on broken grains and débris. The life-cycle of this

species is difficult to determine, the inert periods being passed within the food substance. Approximately, the incubation period is 3 to 4 days, the larval period 4 to 5 days, of which the last two are spent in inertia, and the nymphal period about 8 days, whether in one or two stages is not known. The female deposits 8 or 10 eggs deep among the foodstuff or in some convenient cranny.

Cheyletus eruditus occurs in most grain infested with Tyroglyphid mites, upon which it is predatory, and is also highly cannibalistic. It does not, however, occur in sufficient numbers to control the mites. Parthenogenesis in this species has been proved in the breeding experiments. Several successive generations have been bred in captivity during the year without any male having been observed. It is possible, however, that males may appear under certain conditions, or they may be periodic, as in the Aphids. The eggs of *C. eruditus* are laid in batches of from 20 to 30, often in the longitudinal groove of the wheat grain, the female protecting the eggs until they begin to hatch. Breeding goes on all the year round, but the life-cycle is much prolonged in cold weather, or owing to shortage of food. The average period from egg to adult is probably 36–40 days, the cycle during June being approximately as follows :—Incubation period, 4 days ; larval period, 5 to 10 days ; 1st nymphal period, 5 to 17 days ; 2nd nymphal period, 7 to 20 days. There is generally a period of from 13 to 17 days between the last ecdysis and the first oviposition. The external and internal anatomy of this species is described.

A new mite, a Tarsonemid, *Acarophenax tribolii*, gen. et sp. nov., has been found during these investigations and is described. It is an ectoparasite of the grain beetles, *Tribolium confusum*, F., and *T. castaneum*, Hbst. (*ferrugineum*, Duv.), which do not attack sound grain. The females of *A. tribolii* attach themselves to the eggs of the beetles, from which they suck all the juices, becoming very distended. A hole then appears in the ventral surface, from which as many as from 4 to 15 young mites emerge, males occasionally being seen but never more than one from each parent. These young mites attach themselves to the beetles, a preliminary period on the mature host apparently being necessary for proper development, migration to the egg then following. Many individuals die before migration takes place. The morphology and systematic position of this mite are discussed.

It has become apparent during these investigations that, while Acarids may be found in wheat at all seasons, it is during the warm summer and autumn months that they are most plentiful and most likely to occur in detrimental numbers. Not only is high temperature the reason for this increase, but in the case of grain stored since the previous autumn any process of deterioration due to bacterial activities or to enzymes intrinsic to the wheat itself have had time to develop and cause a large increase of moisture and a rise of temperature. It is when such processes begin that mites generally occur in large quantities. The connection between moisture content and the presence of mites in grain is well known. Moisture determinations of mite-infested stocks show that mites do not injure wheat and flour in which the moisture is 11 per cent. and under, whatever the temperature may be. From 13 per cent. upwards the conditions are very favourable for serious infestation. Under favourable moisture

conditions, increase among the Acarids is very rapid at temperatures between 60° and 75° F., less so between 50° and 60°, while between 40° and 50° it is slow. How and where wheat becomes infested with Acarids is not yet satisfactorily determined. All evidence points to their occurrence in the wheat of temperate countries only; within this limit however their geographical range is extremely wide, the same three or four species occurring all round the world. In wheat from very hot countries, such as India, Acarids rarely occur, probably on account of the low moisture content of such grain.

Wheat that has become badly infested can be much improved, and further damage prevented, by subjecting it to some process that will dry the grain and at the same time kill off most of the mites and remove their bodies, such as a blast of hot air followed by cooling. Wheat in bulk can be so treated in such a machine as the "Hess Drier and Cooler," in which the grain is passed from a band conveyor into a garner, whence it falls into a chamber containing a series of horizontal racks or baffle-plates arranged in a zig-zag manner one above the other. In this chamber the wheat may be brought into contact with a draught of hot air. After a period which varies according to its condition, it is passed into a similar chamber where it is subjected to a draught of cold air and cooled; it then passes into a hopper beneath, and this discharges on to a band conveyor. Cold air is drawn through the lower chamber by a powerful fan, and the same current passes through the fan and is forced on over a series of steam coils, thence going through the wheat in the upper chamber.

The hermetical sealing of vessels containing flour was found to destroy Acarids by asphyxiation, but did not destroy all the eggs, as when fresh air was again admitted borings began after a few days. Dessication is apparently more effective in destroying the eggs than hermetical sealing.

Prevention from Acarid infestation is best secured by storing flour with a moisture content below 11 per cent. For infested flour, heat is probably the best remedy, if applied in time, and for small quantities heating for an hour or more at 150° F. would eliminate further damage. In mills, a lower temperature applied for a longer period would be more practicable. It is found that the lowest absolutely lethal temperature is 120° F., and this must be applied for at least 12 hours to be effective. Lower temperatures than this greatly reduced the numbers of mites but did not ensure the destruction of all eggs. Sifting infested flour through a very fine bolting-silk sieve would remove most of the mites, but the mesh would have to be very fine to prevent the passing of the eggs, which measure only 0·12 by 0·08 mm.

Two papers are included as Appendices; the first, by J. M. Beattie, is a preliminary note on samples of flour submitted for bacteriological examination by Professor Newstead, and is chiefly concerned with bacteria; the second, by A. E. Humphries, is a report on six samples of flour into which mites have been introduced. Examination of these samples lead to the conclusion that mites attack the nitrogenous matter of flour and render the flour in some way, apart from their mere presence, unfit for the manufacture of bread. It was found that the mites could be removed by sifting the flour through No. 14 silk and that practically no mites reappeared in flour that had passed through the sieve; only fine flour will, however, pass through this fine mesh.

It is thought that by some suitable process of sifting a large proportion of infested flour may be recovered for prompt commercial use, free from mites.

DENDY (A.) & ELKINGTON (H. D.). **Report on the Effect of Air-tight Storage upon Grain Insects. Part II.**—*Report of the Grain Pests (War) Committee of the Royal Society, London,* no. 3, November 1918, pp. 3–14.

Further experimental evidence is adduced in this report as to the efficiency of hermetical sealing as a means of destroying insect pests of grain and flour. The results of the experiments detailed are, briefly as follows:—Destruction by hermetical sealing of infested wheat was obtained with larvae and eggs of *Calandra oryzae* at 75° to 80° F. in 28 days, with larvae and eggs of *C. granaria* at the same temperature and period, with larvae and pupae of *C. oryzae* at 88° F. in 25 days. It was found that the early stages of *C. oryzae* are apparently a good deal more susceptible to the effects of hermetical sealing than the adults. An apparently clean sample of Indian wheat, kept for a few months at a warm temperature in a moist atmosphere, became badly infested with *Rhizopertha dominica,* but after hermetical sealing for 23 days at 88° F. the grain was found to be insect-free and after keeping at room temperature for nine weeks still showed no living insects. This beetle was entirely destroyed by hermetical sealing for 3 days at 88° F. in a small air-space. Larvae of *Trogoderma khapra* were destroyed in a small air-space by hermetical sealing for 6 days at 88° F., but the indications are that in a large air-space this species would be considerably less affected than *Calandra* spp. Further experiments in this connection are desirable. The destruction of all insects was obtained by hermetically sealing wheat infested with *Tribolium castaneum* for 2 days at 88° F.; *Laemophloeus* sp. was destroyed in 3 days at 88° F., *Silvanus surinamensis* in 2 days, adults of *Gnathocerus cornutus* in 5 days, larvae of the same species in 3 days, and larvae of *Ephestia kühniella* in 5 days, all at 88°F. Flour heavily infested with larvae of *E. kühniella* was cleared of infestation by sealing for 7 days at 84° to 87° F. Mites occurring abundantly in wheat were destroyed by sealing for 24 hours at 75° to 80° F., and again, in a large air space, in 19½ hours at 88° F. The mite in this case was probably *Tyroglyphus siro.*

In the light of these experiments, it is considered probable that air-tight storage is the best method of preserving grain and cereal products from the attacks of insects or mites, and the same method would also apply to rats and mice. The authors refer to the apparent failure of this method as applied to army biscuits [see this *Review,* Ser. A, i, p. 292] and express doubt as to whether in really hermetically sealed tins any serious damage from *Ephestia kühniella* and other insects could arise. It is suggested that the army authorities should investigate further with a view to determining how far damage can occur in really air-tight tins in which the air-space is kept as small as possible. It is recognised that an experiment with weevil-infested wheat on a large scale is desirable, and it is hoped to carry out such an experiment in the near future.

DENDY (A.). **Experiments with Two Secondary Grain Pests, showing their Inability to attack Sound Wheat.**—*Report of the Grain Pests (War) Committee of the Royal Society, London*, no. 3, November 1918, pp. 15–16.

From the experiments detailed in this paper *Tribolium castaneum* and *Silvanus surinamensis*, beetles that are frequently numerous in damaged grain, have been shown in a manner that is considered conclusive to be incapable of attacking sound wheat.

DENDY (A.). **Observations on the Attraction of Certain Grain Beetles, especially Weevils, by Water.**—*Report of the Grain Pests (War) Committee of the Royal Society, London*, no. 3, November 1918, pp. 17–18.

The attraction of grain weevils to water was tested by plunging beakers containing water, and dry beakers, into wheat to within about an inch of the rim. The results showed that both *Calandra oryzae* and *C. granaria* are largely attracted by water. There is little difference between them in this respect, but when water is present in sufficient quantity in the tube or beaker *C. oryzae* is much more likely to be caught in it than *C. granaria*. Individuals of *Silvanus surinamensis* and *Tribolium castaneum* were also trapped in a similar manner. It seems probable, in view of these facts, that water-traps might prove effective in catching *C. oryzae* in large numbers, while for *C. granaria* damp rags or sponges might be preferable, as this species is able to escape more easily from water-traps. Such traps were suggested many years ago by Miss Ormerod for catching these weevils.

GOSSARD (H. A.) & KING (J. L.). **The Peach Tree Borer, *Sanninoidea exitiosa*, Say.**—*Ohio Agric. Expt. Sta., Wooster*, Bull. no. 329, September 1918, pp. 57–87, 15 figs.

The greater part of the subject-matter of this bulletin has already been noticed [see this *Review*, Ser. A, v, pp. 207 and 368]. Natural enemies of *Aegeria (Sanninoidea) exitiosa* include the Hymenopterous parasites, *Microbracon dorsator*, Say, found during the period of pupation, *Phaeogenes ater*, *Ichneumon irritator*, *Bracon micropictus*, Riley, and *Microgaster* sp.

BECKER (G. G.). **The Apple Woolly Aphis, *Eriosoma lanigerum*, Haus.**—*Univ. Arkansas Agric. Expt. Sta., Fayetteville*, Bull. no. 154, July 1918, 22 pp., 5 plates.

The subject-matter of this bulletin has already been noticed from another source [see this *Review*, Ser. A, vi, p. 311].

Report on the Prevalence of Some Pests and Diseases in the West Indies during 1917. (Compiled from the Reports of the Principal Agricultural Officers.)—*West Indian Bull., Barbados*, xvii, no. 2, 1918, pp. 83–106.

This is a résumé of various local reports, much of the information from which has already been noticed [see this *Review*, Ser. A, vi, pp. 32, 187, 210, 249 and 251].

FELT (E. P.). **Key to American Insect Galls.**—*New York State Mus. Bull., Albany, N.Y.*, no. 200, 1st August 1917, 310 pp., 16 plates, 250 figs. [Received 30th December 1918.]

A brief general account is given of the various galls produced on plants by the activities of insects and of their use and value in commerce. A key is given to the insect galls found in America and a lengthy bibliography on the subject is included, ranging from the year 1841 to 1918. The text is illustrated with excellent photographs and a comprehensive index is added.

GAUTIER (C.). **Etudes physiologiques et parasitologiques sur les Lépidoptères nuisibles. La ponte des *Apanteles*, Parasites de *Pieris brassicae*.** [Physiological and Parasitological Studies on Injurious Lepidoptera. The Oviposition of *Apanteles*, parasitic on *Pieris brassicae*.]—*C.R. Soc. Biol., Paris,* lxxxi, no. 22, 7th December 1918, pp. 1152–1155.

The parasitism of the larvae of *Pieris brassicae* by *Apanteles* or *Microgaster glomeratus* does not begin in the eggs of the butterfly, contrary to the opinion held by Fabre. The Braconid is able to oviposit in the eggs of the host, but such eggs either are destroyed or yield unparasitised caterpillars. The normal oviposition of *Apanteles* takes place in the young caterpillar of *P. brassicae.*

TULLGREN (A.). **Dr. Filip Tryboms efterlämnade faunisliska Anteckningar om Svenska Thysanoptera.** [Faunistic Notes on the Swedish Thysanoptera by the late Dr. F. Trybom.]—*Entomologisk Tidskrift, Stockholm*, 1917, pp. 33–61.

The author publishes the notes regarding the geographical distribution, the habits and food-plants of the Swedish Thysanoptera made by the late Dr. F. Trybom. In all about 50 species and 28 genera are recorded.

ROMAN (A.). **Skånska Parasitsteklar.** [Ichneumonidae from Scania.] —*Entomologisk Tidskrift, Stockholm,* 1917, pp. 260–284.

Information is given regarding the following Ichneumonid parasites: *Automalus alboguttatus*, Gr., bred from *Dasychira pudibunda*; *Amblyteles nonagriae*, Holmgr., from *Nonagria typha*; *Ctenichneumon melanocastaneus* var. *borealis* from *Panolis flammea* (*griseovariegata*); and *Megaplectes monticola*, Gr., from *Dicranura* (*Harpyia*) *vinula*.

ROMAN (A.). **Beiträge zu den Schwedischen Ichneumonides Pentagoni.** [Contributions on the Swedish Ichneumonidae Pentagoni.]—*Arkiv för Zoologi, Stockholm*, Bd. 12, no. 2, 1918, pp. 1–32.

This article contains information regarding the hosts of the following species: *Anisobas platystylus*, Thoms., from the pupa of *Thecla rubi*; *Coelichneumon impressor*, Zett., from *Charaeas graminis*; *Eurylabus torvus*, Wesm., from *Leucania obsoleta*; *Eurylabus tristis*, Gr., from *Dianthoecia albimacula*; *Ichneumon captoris*, Thoms., from *Gnophos*

myrtillata; *Platylabus dolorosus*, Wesm., from *Lygris testata*; *P. pactor*, Wesm., from *Tephroclystia sobrinata*; *Diadromus varicolor* var. *intermedius*, Wesm., from *Plutella maculipennis* (*Cerostoma xylostella*); and *Phaeogenes stipator*, Wesm., from *Depressaria apicella* (*nervosa*).

KEMNER (N. A.). **Ueber die Gattung** *Nothorrhina*, **Redt.** [On the Genus *Nothorrhina*, Redt.]—*Entomologisk Tidskrift, Stockholm*, 1918, pp. 322–328, 4 figs.

A description is given of the larva and pupa of the Longicorn beetle, *Nothorrhina muricata*, Dalm. The larva makes galleries in the bark of old pine trees close to the cambium, pupating in the bark, the development apparently requiring two years.

TRÄGÅRDH (Ivar). **Tallbocken** (*Monochamus sutor*, **L.**). [The Spruce Beetle, *Monochamus sutor*, L.] — *Svenska Skogsvårdsföreningens Tidskrift, Stockholm*, 1918, pp. 221–232, 7 figs.

The data regarding the damage done by *Monochamus sutor* and its life-history are very scanty and partly contradictory, the opinion being prevalent that only spruce trees are attacked, though as a matter of fact both pines and spruces are injured. According to Barbey, this Longicorn beetle is decidedly a secondary pest, whereas it is on the contrary mainly a primary one. When young, the larva excavates large, round chambers under the bark, which attain a width of 2 cm. In the late summer it enters the wood through an oval opening and excavates tunnels measuring 12–13 cm. long and 3–5 mm. wide. The end of the gallery is more circular in transverse section and serves as a pupal chamber, being separated from the surface of the trunk by a thin wall through which the beetle makes its way when emerging.

The data accumulated in Sweden go to prove conclusively that the time required by one generation is only one year and suggests that the beetle prefers newly cut timber, choosing exclusively for oviposition logs placed in the sun, and thus evincing the same habit as the North American species of the genus. It is a serious pest in Sweden on account of the depth to which the galleries penetrate into the wood, the only possible way of checking it being the complete removal of the bark.

TRÄGÅRDH (Ivar). **Tallviveln** (*Pissodes pini*, **L.**) **an allman men i vart land hittills fögs beaktad Skogsinsekt.** [The Smaller Pine Weevil, a Forest Pest common in Sweden but hitherto neglected.]—*Skogen*, 1918, pp. 237–244, 7 figs., also printed as Leaflet no. 12, published by *Statens Skogsförsöksanstalt.*

This short treatise on *Pissodes pini* is based on investigations recently carried out in Sweden by the author. When ovipositing, the female bites a hole through the bark in which the eggs are laid, often several together. This results in the young galleries often radiating from one point and much resembling the larval galleries of some bark-beetles. The injury done by the imago has hitherto almost escaped notice, only one instance being recorded by Lagerberg of injury caused in this way in Sweden. When feeding, the beetle attacks two to four-year old shoots, boring small circular holes through the bark, measuring

from 0·6 to 0·8 mm. in width and leading into oval excavations from 2 to 3·6 mm. wide. The economic importance of this type of injury is as yet unknown.

The data collected in Sweden during recent years show that oviposition commences at the beginning of July and continues throughout the summer, possibly until the beginning of September, and that the beetle decidedly avoids newly felled trees, being in consequence mainly a secondary pest.

ROSTRUP (Sofie). **Undersögelser over Kaalfluen, dens levevis og bekaempelse.** [Investigations in the Life-History and the Methods of controlling the Cabbage Fly, *Phorbia brassicae*, in Denmark.]—*128 Beretning fra Statens Forsögsvirksomhed i Plantekultur, Köbenhavn,* 1918, pp. 255–313, 9 text figs.

A detailed account is given of the experiments conducted against *Phorbia brassicae* in Denmark during the years 1913–1917. This is a serious pest in a country where the cultivation of cabbage and turnips plays such an important part as in Denmark. When the flies make their appearance in the spring there are always radishes and cabbage to maintain a supply of food for the larvae of the first generation, even if the turnips are insufficiently forward for this purpose. Those of the second generation live on both turnips and cabbage, the latter plant being often left in the fields during the winter. It is therefore necessary to clear the fields thoroughly in the winter of cabbage and turnip plants and their refuse. The injury is always more severe in loose soil, in which the flies prefer to oviposit. A dry autumn seems to diminish the attack during the following spring, and drought and cold weather in May and June has the same effect on the pest during the summer.

Preventive methods include:—Early sowing and thinning of the plants, which renders them more capable of resisting attack; thorough fertilising is also useful, but there seems to be reason to believe that the spreading of manure in the spring will attract the flies; watering the plants and hilling them renders them also more capable of resisting attack; and it is advisable to lay out new cabbage beds as far away as possible from the old ones.

Direct remedial methods for this fly include the placing of tarred paper discs around the plants as soon as possible after they have been set out in the field. Tobacco dust and nicotine spray are not reliable, but watering with paraffin emulsion has given promising results; carbolic acid emulsion on the other hand has proved to be useless.

SUDA (K.). **Sanran to Kanki.** [Silk-worm Eggs and Cold.]—*Dai-nihon Sanshikwaiho* [*Report of Japan Sericultural Association*], *Tokyo*, xxviii, no. 324, January 1st 1919, pp. 27–29.

Considerable differences of opinion exist among sericulturists as to the temperature at which the eggs of silkworms should be stored. Some consider that temperatures under 0° C. [32° F.] affect the development of the embryo, while others believe that low temperature may prevent damage to eggs caused by sudden change of climate. The

Tokyo Sericultural Institute and the Koyto Sericultural Institute consider 40° F. (5° C.) to be the best temperature for storing eggs.

The author has carried out several experiments both with natural and artificial temperatures and has found that an average temperature of 5° C. [40° F.] does not affect the vitality of eggs, while two days in - 20° C. [- 5° F.] may have a harmful effect, and if this temperature is maintained for ten days, the stored eggs become worthless. On the other hand, if a temperature as low as 0° C. [32° F.] is maintained for very long, until in fact the eggs are required for hatching, it may seriously affect development. An intermittent temperature of - 20° C. [- 5° F.] may not injure the eggs. On the whole the eggs should be stored at temperatures between 5° C. [40° F.] and 0° C. [32° F.].

NISHIKAWA (I.). **Kasan no Gai-teki ni Kwansuru Kenkyu, I.** [Studies on the Enemies of the Silkworm. I.]—*Dainihon Sanshikwaiho* [*Report of Japan Sericultural Association*], *Tokyo*, xxviii, no. 324, 1st January 1919, pp. 50–59, 6 figs.

The author has discovered ten enemies of silkworms or their eggs, which have not been previously recorded in this connection. Of these, three are described in this paper, viz. :—the Orthopteron, *Diestrammena marmorata*, de Haan, which devours stored eggs; the Noctuid moth, *Aglossa dimidiata*, Haw., the caterpillars of which also feed on stored eggs; and the Carabid beetle, *Crossoglossa latecincta*, Bat., the larva of which bites the silkworm and sucks its juices.

TAKAHASHI (S.). **Kaki oyobi Abura-giri no Dai-gai chu Kuroiraga ni tsukite.** [On a Black Limacodid very injurious to Persimmon and *Aleurites*.]—*Byochugai Zasshi* [*Journal of Plant Protection*], *Tokyo*, vi, no. 1, 5th January 1919, pp. 36–42, 1 fig.

This moth, the caterpillar of which does serious injury to persimmon and *Aleurites cordata*, has been previously recorded as having only one annual generation, but the author believes it to be two-brooded. The larvae that have hibernated pupate in May and adults emerge at the end of that month. The new larvae mature at the beginning of July and adults of the second generation make their appearance between the beginning and middle of August. The resultant larvae are mature in the middle of September and pass the winter within the cocoon.

The eggs are laid on the under-surface of the leaves of the lower branches, in masses of about 700. The young larvae are gregarious at first and feed only on the under-side of the leaf. After the fourth instar they scatter, and devour the whole of the leaf-tissue. It is not uncommon for trees to be entirely defoliated by them.

As regards remedial measures, as the young larvae can easily be detected, they should be collected and destroyed. The adult moths rest on the lower branches, and must be searched for and captured. The migrations of the larvae should be checked by means of barriers, and the cocoons collected. Mixed plantations of persimmon and *Aleurites* should be avoided.

KUWANA (I.). **Taisho shichinen no Gaichu-kai.** [Observations on Injurious Insects of 1918.]—*Byochugai Zasshi* [*Journal of Plant Protection*], *Tokyo*, vi, no. 1, 5th January 1919, pp. 68–70.

A summary is here given of the injurious insects that made their appearance in 1918. The first generation of the two-brooded rice-borer (*Chilo simplex*, Butl.) was more numerous than usual, though the second was much less so except in one or two localities. The three-brooded rice-borer (*Schoenobius incertellus*, Wlk.) was also only numerous in the case of the first brood. Several leaf-hoppers were present, but did not do serious damage to rice, though farmers are warned against treating these pests as unimportant. The Pentatomids, *Aenaria lewisi*, Scott, and *Podops lurida*, Burm., and many Lepidoptera normally infesting rice did not do any marked damage during the year. One area of the Kanagawa District that had suffered previously from cabbage loopers escaped during the period under review. Midges and scale-insects were present in great numbers on mulberries. The year was remarkable for the small number of Aphids that made their appearance. An outbreak of a disease of oranges caused by mites and evidenced by a thickening of the skin was noticeable, as also were radish-infesting borers. *Icerya purchasi* made its appearance in two districts. The caterpillars of *Phalera flavescens*, Brem. & Grey, occurred in several districts. An investigation as to the occurrence of the melon-fly (*Dacus cucurbitae*, Coq.) in Nagasaki, Kagoshima and Okinawa Districts, confirmed its absence. The Formosan orange fly (*Dacus dorsalis*, Hendel) was however found in Okinawa (Loo-choo). New occurrences of the Indian meal moth [*Plodia interpunctella*] were reported, but the author is of opinion that there were no new importations of this pest during the year.

A conference of entomologists and plant pathologists of the Imperial and Local Governments was held at the Department of Agriculture and Commerce and another of the Kiushin Local Governments at Kagoshima. Lecture classes were also held at the Imperial Agricultural Experiment Station and Plant Quarantine Station for prefectural entomologists and plant pathologists.

HOWARD (L. O.). **Report of the Entomologist.**—*U. S. Dept. Agric., Bureau Entom., Washington, D.C.*, 19th September 1918, 24 pp.

This report of the work of the Bureau of Entomology for the year ended 30th June 1918, contains a concise review of work done during the year, emphasis being laid on those activities having a direct bearing on war problems.

Deciduous-fruit insect investigations under the direction of Dr. A. L. Quaintance on the control of the codling moth [*Cydia pomonella*] showed that in the Grand Valley of Colorado six applications of 4 lb. powdered lead arsenate to 200 U.S. gals. water, with the addition of 4 lb. fish-oil soap, was a very effective treatment. In Oregon this pest is not only seriously injurious to apples but causes much loss to pears. The effects of various sprays at different times and under semi-arid conditions are under investigation in New Mexico, the comparative effects of dusting and spraying being noted. Spraying and dusting experiments with both lead arsenate and calcium arsenate have been carried out in connection with the grape-berry moth

[*Polychrosis viteana*], there being some ground for belief that a single timely and thorough spraying will be sufficient and thus do away with the objectionable spray residue on the fruit at harvest time. Special attention has been given to the use of insecticides in pecan orchards in Georgia and Florida. Experimental tests were made of miscellaneous proprietary insecticides and others, both alone and in combination with fungicides. In view of the present high cost of lead arsenate the value of calcium arsenate has been tested, the results indicating that it may be used in all situations where Paris green has been employed, and that it will be a satisfactory substitute for lead arsenate when used with lime or fungicides containing lime. Investigation of an Oriental insecticide, derris, has shown that it acts both as a stomach poison, when however it is effective against only a few insects, and also as a contact insecticide being efficient against a wide range of pests. Tests on the ovicidal action of nicotine have shown that it is not sufficient to control *Cydia pomonella* satisfactorily when used alone. The work on cranberry insects in New Jersey has been completed, and a bulletin on the subject has been published [see this *Review*, Ser. A, vi, p. 561]. Several of the important eastern cranberry pests having been introduced into Washington with plants from the east, it will be necessary to study them under their new western conditions. The methods of control of the blackhead fireworm [*Rhopobota vacciniana*] adopted in the east are also effective in the State of Washington. It appears probable that the peach borer [*Aegeria exitiosa*] may be controlled by the proper use of paradichlorobenzine applied in small doses round the base of the tree in autumn, and this at a minimum cost. The so-called oriental peach moth [*Cydia molesta*], a newly-established peach pest from Japan, also attacks apples, pears, quinces, plums and cherries, and bids fair to be a serious pest. About 50 species of parasites of the grape-berry moth [*Polychrosis viteana*] have been found, only 7 or 8, however, being of sufficient numerical importance to be at all effective. A new disease attacking the citrus mealy-bug [*Pseudococcus citri*] has been discovered. Eradication work in connection with a Japanese beetle (*Popillia japonica*) has been systematically undertaken. This pest was probably introduced in 1911 in the egg or larval stage in the soil surrounding the rhizomes of Japanese iris. It is now heavily infesting about 625 acres, with scattered infestations over some 7,000 to 10,000 acres and with outlying infestations over not less than 25,000 acres. It is a very general feeder, attacking grape, apple, cherry, buckwheat, sweet potato and maize, as well as many ornamental plants and weeds. The immature stages are passed in the soil, where the larvae feed on decaying vegetable matter. The adults appear in midsummer, continuing till cool weather in autumn; spreading occurs during the hot weather, at which time the beetles are strong fliers. Eradication has been attempted by treating infested soil with sodium cyanide solution, by ploughing the breeding grounds, and by keeping the insects away from roadsides by the use of kerosene and other means. Direct measures include the application of poisons to the entire infested areas as nearly as possible, working from the periphery inwards, and by hand-picking the adults.

Cereal and forage insect investigations under the control of Mr. W. R. Walton made it evident that *Pyrausta nubilalis* (European

corn-borer) had become established in eastern Massachusetts [see this *Review*, Ser. A, vi, p. 554], the maize crop being so seriously damaged as to cause the gravest apprehensions should this insect spread into the great maize belt of the middle west. As the insect hibernates in the stalk of the host-plant, winter destruction is possible, though extermination would be a matter of great difficulty and expense owing to the number of food-plants of this moth. An extension of the alfalfa weevil [*Hypera variabilis*] into Colorado during the summer of 1917 and affecting about 3 square miles is being dealt with by co-operative treatment. In Utah, Idaho and Wyoming, where the weevil has been present for some years, its natural enemies, introduced from Europe in large numbers, have greatly increased and are giving material aid in controlling it. During 1917 considerable damage was done throughout northern Texas by the chinch bug [*Blissus leucopterus*], but the outbreak of 1918 was subdued partly by the very heavy spring rains, and largely by communal action early in the season. Forage crops throughout the western and north-western states sustained severe and widespread injury by grasshoppers in 1917, the loss in 1918 being greatly reduced by the co-operative movement organised against them. A similar campaign in eastern Kansas against the Hessian fly [*Mayetiola destructor*], in the autumn of 1917, secured the ploughing down of stubble and the general observation of the safe planting date, resulting in greatly improved conditions during 1918. Winter wheat was rather seriously injured by a wheat-infesting sawfly in Maryland, the pest being present throughout that State, as well as in Pennsylvania and northern Virginia. This insect has been identified as *Trachelus tabidus*, a European species present in Pennsylvania since 1913, and hibernating in the wheat stubble of the current year.

During the course of stored-product insect investigations under Dr. E. A. Back, arrangements were made with the Quartermaster's Department of the Army whereby food and clothing supplies intended for overseas shipment were frequently inspected by experts, thus rendering possible the detection and check of insect ravages before great loss had been caused.

Under the direction of Dr. F. H. Chittenden special attention was given under an emergency appropriation of £6,000 to the study of the sweet-potato weevil [*Cylas formicarius*] in its occurrence in the Gulf States. The methods adopted included a farm-to-farm survey, large scale experiments at field stations, demonstration of eradication projects, and an educational campaign by inspectors. As a result of these it seems probable that the end of another season's work may find the sweet-potato crop of the least-infested of these States to be nearly free from the weevil. The experimental curing of sweet-potatoes by heat has shown the possibility of destroying 95 per cent. of weevils in storage houses by heating the tubers to 115° F. for 8 days. In badly infested districts in Texas, losses due to weevil injury have been reduced from 50 per cent. to less than 10 per cent. by the timely application of arsenical sprays.

Work against southern field-crop insects carried out under Dr. W. D. Hunter have resulted in the discovery that the cotton boll weevil [*Anthonomus grandis*] can be controlled by dusting with lead arsenate or calcium arsenate [see this *Review*, Ser. A, vii, p. 74].

Research work has also been carried out on the pink bollworm of cotton [*Pectinophora gossypiella*], sugar-cane insects in south-western Texas, tobacco insects, and insect pests of castor beans.

Forest insects were studied under the supervision of Dr. A. D. Hopkins, and it was shown that the very heavy loss in ash logs in Mississippi was due to failure to utilise them promptly after the trees were cut and thus prevent the attack of borers. The California survey of the pine belt along the western flank of the Sierra Nevada Mountains showed that the loss in 1917 due to tree-killing beetles amounted to about £12,000. In the south-west, where the mesquite [*Prosopis*] furnishes the only local supply of fuel, etc., heavy losses occur each year from wood-boring insects. It has been found that this can be avoided by cutting in November and December and piling in loose ricks. Timber cut during other months is seriously affected and in some cases entirely destroyed. The black locust tree [*Robinia pseudacacia*], which is valuable as supplying pins used in the construction of wooden ships, is so seriously damaged by the locust borer [*Cyllene robiniae*] that hitherto it has not been found practicable to grow it commercially. Experiments have shown, however, that the young trees can be protected by spraying with a poisoned liquid, or by the planting of some quick-growing shade-producing plant between the rows in plantations.

Investigations on the control of tropical and sub-tropical fruit insects, under the charge of Mr. C. L. Marlatt, showed that the citrophilus mealy-bug [*Pseudococcus citrophilus*], a comparatively new pest, infesting a few trees in 1915 but now covering an area of about 1,000 acres, can be eliminated by spraying the trunks of the trees, utilising predatory natural enemies, and controlling the Argentine ant [*Iridomyrmex humilis*] by the use of poisoned syrup. Investigations on the use of liquefied hydrocyanic acid gas have shown that this method bids fair to supersede that of generating the gas at the moment of use. The control of the fluted scale [*Icerya purchasi*] has been accomplished in and around New Orleans by the propagation and liberation of over 300 colonies of *Novius cardinalis* over an area of 40 square miles, and also by the control of the Argentine ant. Quarantine measures regulating the shipping of fruits and vegetables from Hawaii to the mainland have been enforced as a means of protection against the Mediterranean fruit-fly [*Ceratitis capitata*] and the melon fly [*Dacus cucurbitae*].

The extension and demonstration work of the year is recorded in detail, also the institution of a war emergency entomological intelligence service. Bee-keeping extension work is fully treated, it having been undertaken as a war-measure for increased food-production.

During the year ended 30th June 1918 the area infested by the gipsy moth [*Porthetria dispar*] in the New England States has increased by 1,880 square miles, nearly half of this being in Maine, an area in which it is very difficult to prevent the spread of the small caterpillars owing to the prevalent warm west and south-west winds. Isolated colonies found during previous years appear to have been exterminated. During the year the territory infested by the brown-tail moth [*Nygmia phaeorrhoea*, Don.] has been reduced by 3,694 square miles. Special attention has been paid in towns just within the border of the infested areas to discovering and stamping out infestations on high elevations,

and thus preventing the distribution of small caterpillars by wind. New and very powerful spraying machines have been introduced capable of forcing the spraying liquid through a mile of 1⅛-inch hose. An abnormally severe winter caused a material reduction in the infestation in many localities, and this may have also reduced the increase of some of the introduced egg-parasites, though this cannot be determined till later in the season. Nearly 2,000,000 specimens of *Schedius kuvanae*, the egg-parasite of the gipsy moth, were released late in September and October. In the spring of 1918 less than 2,000,000 specimens of *Anastatus bifasciatus*, a single-brooded egg-parasite of the gipsy moth, were liberated, being fewer than in the previous year owing to the severe winter. *Compsilura concinnata* was reared from a number of native caterpillars not previously known to be hosts of this parasite. *Blepharipa scutellata*, a Tachinid that parasitises large gipsy-moth caterpillars and emerges from the pupae, was more numerous in the summer of 1917 than in any other year since its introduction. *Apanteles melanoscelus*, which has two annual generations, the first of which attacks small gipsy-moth caterpillars and the second nearly full-grown ones, was satisfactorily bred for colonisation by a new method. *Calosoma sycophanta* was more abundant than usual in badly infested sections. No severe infestations of the brown-tail moth having been recorded, there was a corresponding decrease in the abundance of its imported parasites. Attempts have been made to determine the abundance of the brown-tail moth fungus in the winter webs, and studies have been made of an unnamed fungous disease in eggs of the gipsy-moth, and of a bacterial disease which originated in Japan and attacks the gipsy-moth caterpillars in the field.

ROHWER (S.A.). **Descriptions and Notes on some Ichneumon-flies from Java.**—*Proc. U.S. National Museum, Washington, D.C.*, liv, 1918, pp. 563–570. [Received 2nd January 1919.]

The species dealt with in this paper are: *Eripternimorpha scirpophagae*, sp. n., and *E. dammermani*, sp. n., reared from the pupa of *Scirpophaga sericea*; *E. javensis*, sp. n., from the pupa of *S. intacta*: *Echthromorpha notulatoria*, F., from the pupa of *Ocinara signifera*; *Theronia zebra*, Vollenh., from the pupa of *Cricula trifenestrata*; *Apanteles* (*Protapanteles*) *bataviensis*, sp. n., from the larva of *Odonestis plagifera*; *A. belippae*, sp. n., from the larva of *Belippa bohor*; *A. javensis*, sp. n., from the larva of *Hesperia conjuncta*; *Amyosoma zeuzerae*, sp. n., from the larva of *Zeuzera coffeae*; *Platybracon javensis*, sp. n., reared from a cocoon collected under bark and believed to be parasitic on *Chrysobothris sexnotatus*; *Oncophanes hesperidis*, sp. n., reared from a Hesperid larva; and *Horniopterus schoenobivorus*, sp. n.,* from the pupa of *Schoenobius** *incertellus* (*bipunctifer*), all from Java.

GAHAN (A. B.). **Four New African Parasitic Hymenoptera belonging to the Subfamily Microgasterinae.**—*Proc. U.S. National Museum, Washington, D.C.*, liv, 1918, pp. 587–590. [Received 2nd January 1919.]

The species dealt with in this paper include:—*Microgaster fasciipennis*, sp. n., reared from *Deilemera apicalis*, Wlk.; *Apanteles*

[* These names are emended, being written *choenobivorus* and *Choenobius* in the original.—ED.].

pallidocinctus, sp. n., reared from *Papilio demodocus*, Esper; and *A. ugandaensis*, sp. n., from a Pyralid on *Hibiscus*.

Cereal and Forage Insect Work.—*13th Ann. Rept. Commissioner Agric. Commerce and Industries, State of S. Carolina, 1916; Columbia, S.C.*, 1917, pp. 155–156. [Received 2nd January 1919.]

No serious outbreaks of insects affecting cereal and forage crops were reported during the early part of 1916, but later in the year considerable damage was done to various crops by insects, the most important being:—*Cirphis unipuncta* (army-worm), which did considerable damage to a field of millet but was so efficiently controlled by its parasites that the next generation was unimportant; *Laphygma frugiperda* (fall army-worm), the caterpillars of which were quite common during late summer, but not abundant enough to do serious damage to crops; this moth probably does not hibernate in South Carolina, but comes every year as a migrant from more southerly regions, probably Florida; *Sphenophorus* spp. (bill-bugs), which did considerable damage to maize in river-bottom lands; *Elasmopalpus lignosellus* (lesser corn-stalk borer), which damaged cow-peas and sorghum, plants growing in sandy parts of the fields suffering the most; and a small bug, *Halticus citri*, found doing considerable damage to lucerne in Georgia and recently found in lucerne fields round Columbia.

Cereal and Forage Insect Work.—*14th Ann. Rept. Commissioner Agric. Commerce and Industries, State of S. Carolina, 1917; Columbia, S.C.*, 1918, pp. 142–149, 6 plates. [Received 2nd January 1919.]

Heliothis obsoleta, F., is sometimes an important pest of vetch, crops of which have been seriously damaged in South Carolina by it during recent years. The damage is caused by the larvae devouring the leaflets and boring into the pods and eating the seeds, the most serious outbreaks occurring during seasons of cool and moist weather.

The number of generations annually is probably six in the south, but it is only the first of these that affects crops of vetch. The caterpillars cannot well be controlled on vetch by spraying owing to the manner of growth of this plant, but where this is sparse, a solution of 2 lb. powdered lead arsenate in about 50 U.S. gals. water may be used; 1 lb. Paris green may be substituted for the lead arsenate, a few pounds of lime being added to prevent scorching. A poisoned bait made of 50 lb. wheat bran, 2 lb. lead arsenate, 2 U.S. gals. low-grade molasses and 6 finely chopped lemons, and sown broad-cast over the field exerts a good measure of control. If however the crop is heavily infested, it should be cut for hay at once and not be left to stand for seed; before cutting, a deep furrow should be ploughed round the field to safeguard surrounding crops from migrating larvae.

Dobson (R. D.). **A European Termite, *Reticulotermes lucifugus*, Rossi, in the Vicinity of Boston.**—*Psyche, Boston, Mass.*, xxv, no. 5, October 1918, pp. 99–101. [Received 3rd January 1919.]

Only one species of termite, *Reticulotermes flavipes*, Kollar, has hitherto been found in the United States north of New Jersey, but in May 1918 a few colonies of *R. lucifugus*, the common European termite of the Mediterranean region were found in the vicinity of

Boston. The fact of its not having occurred in earlier collections points to its limited distribution, while the size of the colonies proves that they must have been established for some years, having probably been accidentally introduced from Europe. In the case of *R. flavipes* the development to the adult state apparently takes place as early in the spring as the weather will permit, that of *R. lucifugus* occurring about 3 weeks later.

YOTHERS (W. W.). **Spraying for the Control of Insects and Mites attacking Citrus Trees in Florida.**—*U.S. Dept., Agric., Washington, D.C.*, Farmers' Bull no. 933, March 1918, 38 pp., 24 figs. [Received 3rd January 1919.]

The bulk of the subject matter of this bulletin has already been noticed [see this *Review*, Ser. A, i, p. 186, iii, p. 444, and vi, p. 216].

WATSON (J. R.). **The California** *Delphastus*.—*Florida Buggist, Gainesville*, ii, no. 2, September 1918, p. 88. [Received 3rd January 1919.]

Delphastus catalinae, a Coccinellid predaceous on whiteflies, is multiplying most satisfactorily in Florida and arrangements have been made for distributing it further.

WATSON (J. R.). **An Outbreak of the Cotton Stainer on Citrus.** —*Florida Buggist, Gainesville*, ii, no. 2, September 1918, pp. 88–90. [Received 3rd January 1919.]

A cotton stainer, *Dysdercus suturellus*, H.S., has been causing loss to citrus and avocado growers in the southern parts of Florida by puncturing the rind of the fruit and causing it to drop from the tree and decay. The punctures are smaller than those caused by *Nezara viridula* (pumpkin bug), being entirely invisible to the naked eye. The insects, which feed by day on thin-skinned varieties of citrus, chiefly tangerines, are distinctly gregarious, collecting in colonies on the leaves and fruit both on the tree and on the ground.

No outbreak has been recorded in communities where no cotton has been planted, whereas groves near cotton have been found heavily infested with both young and adults, and even those three-quarters of a mile distant with the strong-flying adults.

If the pest is to be controlled, it is essential that cotton should not be planted in citrus areas, while fowls afford an accessory means of keeping it in check. A closely-related species, *D. delauneyi*, Leth., has been effectively dealt with in St. Vincent by the destruction of its wild food-plants, and it is thought that the same result might be obtained in Florida by destroying the Spanish cockle-burr (*Urena lobata*), on which it largely breeds in the absence of cotton.

VOGLINO (P.). **Osservazioni sulla Biologia delle Tignole della Vite e sulle Esperienze di Lotta fatte nel 1915-1916.** [Observations on the Biology of the Vine Moths and on Control Experiments made in 1915–1916.]—Separate from *Boll. Minist. Agric., Industria e Commercio, Serie B, Rome*, July–October 1917, 7 pp. [Received 2nd December 1918.]

As regards the spring generation of *Polychrosis botrana* and *Clysia ambiguella* in Piedmont in years in which the spring has a succession

of days with a nearly constant average daily temperature, there is a mass-emergence of the moths, so that the life of the adults occurs within a restricted period and remedial measures are facilitated. The summer generation is rather irregular, which explains the difficulty experienced in combating it and the greater damage done. It is supposed that the hibernating pupae are very sensitive to the rise of temperature in spring and that this leads to the simultaneous emergence of most of the adults, so that, except in the case of a few individuals, the entire life-cycle occurs in May and June. In summer, emergence is spread over a longer period, from July to September. Owing to this and to the period of development of the two species not being the same, there are present, at one and the same time, the mature spring caterpillars and pupae of *P. botrana* and pupae, adults and summer caterpillars of *C. ambiguella*. *P. botrana* is more common in sunny, dry places where the temperature is rather high, while *C. ambiquella* predominates in shady, cool situations. Owing to this *P. botrana* appears at a later date than *C. ambiguella* in localities where they occur together. Sticky papers and bait-traps are useful for indicating the time of appearance of the moths. Infestation is more severe in vines with abundant foliage, as the grapes are shaded, giving rise to a close and damp condition that favours the pests.

ROEPKE (W.). **Entomologische Onderzoekingen.** [Entomological Research.]—*Meded. Proefstation Midden-Java, Salatiga*, no. 32, [Report for 1917–1918], 1918, pp. 13–14. [Received 5th December 1918.]

The best means of combating *Araecerus* infesting stored coffee consists in drying, heating and sorting the infested beans. Fumigation with carbon bisulphide at the rate of 150 gms. per cubic metre is fatal to this beetle; *Coffea liberica* is not notably discoloured and *C. robusta* even less so. The aroma and taste of coffee from treated beans are not affected. Fumigation with sulphur di-oxide or hydrocyanic acid gas and submerging the beans in water are not recommended. *C. robusta* of inferior quality, such as is grown by the natives, is susceptible to infestation. The species of *Araecerus* attacking mace and cacao is the same as that infesting coffee, but the species infesting the pods of *Tephrosia* and other Leguminosae does not attack coffee, nor does the coffee beetle attack Leguminosae [see this *Review*, Ser. A, vi, p. 2].

Cacao of good quality was infested by *Lasioderma*, while inferior grades were attacked by *Setomorpha, Araecerus, Silvanus, Tribolium, Carpophilus*, etc. Fumigation with carbon bisulphide is advised against these pests, and some estates have decided to erect fumigation chambers. *Helopeltis* and cacao moth [*Acrocercops cramerella*] did much damage in some places. On one estate some parasites of the latter, chiefly *Mesostenus* sp., were bred and released, but up to the time of writing no results had been recorded.

VAN DER GOOT (P.). **Zur Kenntnis der Blattläuse Java's.** [A Contribution to the Knowledge of the Aphids of Java.]—*Contributions à la Faune des Indes Néerlandaises, Buitenzorg*, i, no. 3, 1917, pp. 1–301, 52 figs.

This valuable monograph is the result of studies made during a residence of two years in Java. Owing to the absence of winter the

breeding of Aphids in the tropics occurs as a continuous series of parthenogenetic generations. Even in the hills, where the temperature sometimes drops to freezing point, the author did not observe sexual forms; nor was a regular migration, such as may be noted in Europe in the spring in the case of PEMPHIGINAE, observed in Java; but this point is not definitely settled. Alate forms probably occur in all tropical Aphids. They are mostly present at the beginning of or during the dry season, but many examples are also to be found during the rainy season. Most European investigators maintain that the alate forms are due to the drying up of the food-plant, but that this is not always correct is proved by the appearance at the end of the dry season, and only then, of some Aphids living on bamboo foliage and belonging to the genus *Oregma*, Buckt., such as *O. insularis* and *O. striata*. In the case of species such as *O. minuta*, the alate forms are not uncommon early in August, *i.e.*, in the middle of the dry season. In Java the majority of Aphids are most numerous early in the dry season, and both prolonged, intense drought and violent rainfalls injure them. Variations in shelter, as afforded by different host-plants, are of great importance in this connection, and the species living on bamboo foliage are most common at the end of the rainy season. Natural enemies include Syrphid larvae, Coccinellids, especially the genus *Scymnus*, and Ichneumonids. These appear to be the main factor in checking the increase of Aphids.

Descriptions are given of 75 species, of which 47 are recorded as new to science. Several generic and specific keys and a list of food-plants are included. Only two species are recorded as injurious:—*Oregma lanigera*, Zehnt., on sugar-cane, and *Myzoides persicae*, Sulz., on tobacco.

CHUKICHI HARUKAWA & NOBUMASA YAGI. **Ueber die Lebensweise des Pfirsichtriebbohrers, *Laspeyresia molesta*, Busck.** [The Life-History of the Peach-shoot Borer, *Cydia molesta*.]—*Berichte Ōhara Instituts für landwirtschtl. Forschungen; Kuraschiki, Okayama, Japan*; i, no. 2, 1917, pp. 151–170, 2 plates. [Received 16th December 1918.]

There are three species of *Cydia* (*Laspeyresia*) injurious to the peach in Japan. *Cydia pomonella*, L., *C. persicana*, Sasaki, and a third species which the authors consider to be identical with *C. molesta*, Busck. The damage done by the last-named has attracted attention since 1902. Sasaki began to investigate this pest, and later on Matsumoto found that not only the shoots of the peach but also its fruit and those of *Pyrus sinensis* (sand pear) are attacked. His investigations have elucidated many points in the life-history. According to him 4 generations a year occur in the province of Okayama and towards the end of July the fruit of *P. sinensis* begin to be infested, the attack being more severe in varieties that ripen late. In 1916 Takachiho published his investigations, and the present authors agree with him and Matsumoto on the main points. *C. molesta* is distributed throughout Japan, except in Hokkaido and the northern portions; it occurs in Korea, but not in the Loochoo Islands and Formosa. It is believed not to be a native of Japan, for the damage it does was not noticed prior to 1899. Brief descriptions are given of the egg, larva,

pupa and cocoon. In Okayama, on the south coast of western Japan, there are 5 annual generations, the caterpillars of the last of which hibernate; and as Nodzu has recorded 4 from the north coast, it is evident that this is due to the influence of climate. The first adults appear late in April and caterpillars may be seen boring as late as mid-October. In orchards caterpillars in varying degrees of development are found throughout the summer and up to late autumn. In field cages the life-cycle varied from 26 to 37 days. The moths fly at twilight, at which time mating and oviposition occur. As a rule the eggs are deposited on the leaves, but the fruit of the pear is often chosen. The number of eggs per female varies from 5 to 65. The egg-stage lasts from 2 to 4 days, the larval stage, 11 to 15, and the pupal stage, 6 to 10. *C. molesta* prefers young peach shoots, but it readily adapts itself to other plants and may infest widely different Rosaceae. According to Murata, the apple, peach, cherry and Japanese cherry are attacked. The authors noted oviposition on *Pyrus sinensis, P. communis* (pear), *Prunus mume*, Japanese cherry, common cherry, apple, plum (*Prunus domestica*) and sand cherry (*Prunus puvimura*) and were also able to breed *C. molesta* on all these except apple. The nectarine is less severely attacked than other peaches. It was also possible to rear the caterpillars on the fruit of apple, peach, pear and *Pyrus sinensis*, so that the fruit of the two last-named are doubtless also attacked. The injury done by *C. molesta* is described [see this *Review*, Ser. A, vi, pp. 369, 378].

ILLINGWORTH (J. F.). **Work of the Division of Entomology.**—*18th Ann. Rept. Queensland Bur. Sugar Expt. Stations, Brisbane*, 22nd October 1918, pp. 24–29. [Received 2nd January 1919.]

Progress is recorded during the year in the work of controlling grubs infesting sugar-cane, largely in consequence of increased knowledge of their habits. Much emphasis is laid on the importance of humus-forming material in the soil as a factor in their control. Laboratory experiments of placing megass in the soil of potted cane plants had very encouraging results, the grubs preferring to feed upon this organic material rather than upon sugar-cane roots. The conservation of trash on red volcanic soils is recognised as a difficult matter, but it must be done unless a great deal of time is to be given up to green manuring. The waste from the ratoon crop should be worked in and this followed with a heavy green crop of maize or beans before the soil is used for sugar-cane. At one mill all the waste is composted by building up layers of all the by-products from the mill and the compost is left for about a year before it is put on the land. About 20 tons of this are applied per acre and the cane shows a marked increase in growth where it is used. Late planting is also of considerable importance in infested areas [see this *Review*, Ser. A, vi, p. 526], but will only succeed on soils that are so easily drained that they may be thoroughly worked in December and January. It is the thorough cultivation during the flight of the beetles that effects control, late planting only facilitating this. It is found that the more deeply rooting varieties of cane are better able to withstand attack by grubs, and are far more resistant to the borer beetle [*Rhabdocnemis obscura*] than some of the more usually grown varieties.

Lepidiota frenchi, a grass-feeding species, is becoming a serious pest of sugar-cane at Meringa, migrating from grass borders and roadsides into the cane-fields and eating off all the roots of the cane plants. Fields attacked by these beetles show patches of yellow and dead cane among the dark green, healthy plants. After heavy rains in November the damage from this species became considerably less. As there had been a great abundance of parasitic wasps for a month or more, it is probable that they were responsible for much of the mortality among the grubs. Experiments with poisons in the same field were very encouraging. Sodium arsenate mixed with megass and applied in a furrow along the rows of infested plants apparently killed all the grubs. Experiments with repellents gave negative results. Various tests are being carried out in the experimental plots at the experiment stations.

Further artificial methods of control advocated for the beetles include the destruction of all Moreton Bay ash trees within a circumference of about a mile of the cane-fields, as both *L. frenchi* and *L. rothei* show a decided preference for the foliage of these trees, as also do the greyback beetles [*L. albohirta*], [see this *Review*, Ser. A, vi, p. 323]. Simple light-traps, such as a lantern suspended over a tub of water with a little kerosene on the surface, catch a great many of the beetles, and should be used at dusk before the beetles reach the feeding trees. Small fires round the cane-fields, started at dusk and kept up for about an hour in the evening during the flight of the beetles, also destroy numerous individuals.

Natural enemies, including the green muscardine fungus [*Metarrhizium anisopliae*], and the digger wasps, *Campsomeris tasmaniensis* and *C. adula*, have been dealt with in various reports issued during the year [see this *Review*, Ser. A, vi, pp. 245 and 495]. Bird enemies of cane-grubs that follow the plough and devour large numbers of the larvae include ibis and pewee larks; bandicoots are useful in the same way.

Among other cane pests the borer beetle [*Rhabdocnemis obscura*] is becoming increasingly abundant, owing largely to lack of care in the selection of clean setts. In one district where the beetles have been abundant the Tachinid parasite, *Ceramasia sphenophori*, has become well established, and is proving a very efficient control. A previous attempt to establish this parasite led to the conclusion that it could not live in Queensland, but it is now hoped to transfer it during favourable conditions to other centres of infestation. Both *Cirphis unipuncta* (army-worm), which attacks the edges of the leaves of young cane plants, and *Phragmatiphila truncata* (Noctuid borer), which feeds inside the shoots and kills the central leaves, are troublesome pests of sugar-cane, but are prevented by parasites from doing serious damage. It is suggested that these caterpillars might be checked by the application of a green crop of beans or peas before cane is again planted. This would only be successful if there were no infested fields of cane in the vicinity.

NIISIMA (Y.). **Eine neue Gattung der Borkenkäfer.** [A new Genus of Bark-Beetles.]—*Collection of Essays for Mr. Yasushi Nawa, Gifu*, October, 1917, pp. 1–3. [Received 3rd January 1919.]

A new bark-beetle, *Orosiotes kumamotoensis*, gen. et sp. n., is described from specimens collected at Kumamoto, Japan.

OSHIMA (M.). **Two Species of Termites from Foochow, China.**—*Collection of Essays for Mr. Yasushi Nawa, Gifu*, October 1917, pp. 5–7. [Received 3rd January 1919.]

Buildings at Foochow, China, are recorded as having been attacked by two species of termites, *Coptotermes formosanus*, Shiraki, and *Odontotermes* (*Cyclotermes*) *formosanus*, Shiraki, of which the soldier and worker forms are described.

MAKI (M.). **Three New Species of *Trichosiphum* in Formosa.**—*Collection of Essays for Mr. Yasushi Nawa, Gifu*, October 1917, pp. 9–20, 3 plates. [Received 3rd January 1919.]

The genus *Trichosiphum*, Perg., has been recorded only from Japan, Formosa and Ceylon. A key is given to six of the seven species at present known, including the following new ones, the various stages of which are described:—*Trichosiphum nigrum* on *Quercus formosana*, *T. formosanum* on *Psidium guayava* (guava) and *Ficus* spp., and *T. nigrofasciatum* on *Quercus formosana*, *Q. serrata* and *Q. variabilis*.

MATSUMURA (S.). **Synopsis of the Pemphigidae of Japan.**—*Collection of Essays for Mr. Yasushi Nawa, Gifu*, October 1917, pp. 39–94, 4 plates. [Received 3rd January 1919.]

Since 1914 the author has been collecting material about the Japanese Aphids and in the present paper gives the results of his study of the family PEMPHIGIDAE, to which little attention has been paid. He divides this family into the four subfamilies VACUNINAE, PEMPHIGINAE, HORMAPHIDINAE and MINDARINAE. A key is given to the 19 genera included in these, comprising in all 29 species.

The following are described as new:—*Astegopteryx styraci*, which forms galls on *Styrax obassia*; *Nipponaphis yanonis*, found on *Distylium racemosum*; *Cerataphis saccharivora*, taken in Formosa on the underside of leaves of *Saccharum officinarum* (sugar-cane), covered with white cottony secretions; *Mansakia miyabei*, gen. et sp. n., which makes a large chestnut-like gall on the apical branch of *Hamamelis japonica*; *Schlechtendalia miyabei*, which forms galls on the branches of *Rhus semialata*; *S. intermedia*, which also forms galls on *R. semialata* and may be identical with *S. chinensis*, Licht.; *Nurudea ibofushi*, gen. et sp. n., *Nurudeopsis shiraii*, gen. et sp. n., *N. yanoniella* and *Fushia rosea*, gen. et sp. n., all forming galls on *Rhus semialata*. *Tetraneura yezoensis* and *T. fusiformis* form galls on *Ulmus campestris* var. *major*; *Gobaishia japonica*, gen. et sp. n., on *Ulmus campestris* and *U. montana*; *G. nirecola*, of which the gall-making spring form occurs on *U. campestris* var. *major* and the root-attacking summer form on *Panicum*, *Setaria* and *Triticum*; *Schizoneura japonica* causes the leaves of *Ulmus campestris* var. *major* to curl into a roll in which the larvae develop until winged imagines of the first series appear and migrate for reproduction to some intermediate host, such as *Ribes* or various Rosaceous plants. Other species recorded are:—*Pemphigus dorocola* and *P. niisimae*, forming galls on *Populus balsamifera*: *Watabura nishiyae*, gen. et sp. n., living on *Cydonia vulgaris* and possibly at the root of apple; and *Nishiyana aomoriensis*, gen. et sp. n., of which the food-plant is unknown.

Swain (A. F.). Miscellaneous Studies in the Family Aphididae (Hem., Hom.).—*Entom. News, Philadelphia*, xxix, no. 10, December 1918, pp. 361–369, 6 figs.

Certain questions concerning the identity and synonymy of various genera and species of Aphids are discussed, and the author's conclusions, the results of study of this family in California, are given.

The genus *Macrosiphoniella* was described by Del Guercio, with *Macrosiphum atrum*, Ferr., as the genotype. The author agrees with Del Guercio in placing certain species hitherto included in *Macrosiphum* in this genus, and gives the latter's key for differentiating *Macrosiphoniella* from *Megoura*, Buckt., and *Macrosiphum*, Pass. These are :—*Siphonophora absinthii*, Koch, *S. artemisiae*, Boy. (*tanacetaria*, Koch), *Aphis campanulae*, Kalt., *Macrosiphoniella chrysanthemi*, Del G., *Siphonophora linariae*, Koch, *S. lutea*, Buckt., *Aphis millefolii*, F., *A. solani*, Walk., and *A. viciae*, Kalt. To these the author adds *M. sanborni*, Gillette, taken on chrysanthemums in California, while Van der Goot includes *M. citricola*, v. d. G.

With regard to *M.* (*S.*) *artemisiae*, Boy., Wilson recorded a species from *Artemisia* in Oregon under this name, treating *S. frigidae*, Oestl., as a synonym of it. *S. frigidae*, however, is distinct and belongs to *Macrosiphum*, while *S. artemisiae* belongs to *Macrosiphoniella*, the latter species not having as yet been reported from America.

An Aphid recently discovered by the author on cypress (*Cupressus guadalupensis* and *C. macrocarpa*) in California was described as *Cerosipha cupressi*, being placed provisionally in this genus. A new generic name, *Siphonatrophia*, is now erected for it. This species lives singly on the tips of cypress leaves. Alate forms are very rare, indicating the existence of an alternate host-plant, which however is as yet unknown. A key is given differentiating *Siphonatrophia* from *Brachycolus*, Buckt., of which the type is *Aphis stellariae*, Hardy, and from *Cryptosiphum*, Buckt., of which the type is *C. artemisiae*, Buckt.

The genus *Monellia*, described by Oestlund with *Aphis caryella*, Fitch, as the type, was separated from *Callipterus*, Koch, on the horizontal position of the wings when at rest. This character, however, is not constant either in the type species or in *M. californica*, and the retention of the name is not considered justifiable. The four known species of *Monellia*, *M. californicus*, Essig, *M. costalis*, Fitch, *M. caryae*, Monell, and *M. caryella*, Fitch, should therefore be referred to *Callipterus*. All these have as their host-plants either *Carya* spp. or *Juglans* spp. or both.

Examples of a species of *Thripsaphis* found on leaves of *Carex* sp. in California are described as *Thripsaphis caricicola*, sp. n. It appears to be very closely related to *T. verrucosa*, Gill., of which only apterous oviparous females have been described.

Jardine (N.K.). The Tea Tortrix (*Homona coffearia*, Nietner).—*Ceylon Dept. Agric., Peradeniya*, Bull. no. 40, November 1918, 38 pp., 14 figs., 1 map.

The greater part of the subject-matter of this bulletin has already been noticed from a previous report [see this *Review*, Ser. A, vi, p. 540].

As regards remedial measures it is suggested that two adjacent rows of tea bushes along those ridges swept by the south-west monsoon should be allowed to run to seed, as they would make a most efficient break to the flight of the adults of *Homona coffearia* and prevent their spread. When the pest is thoroughly established in these bushes, it can be destroyed by the use of insecticidal sprays, which would do no damage to the seed-bearing trees, nor depreciate the value of the tea as is the case when bearing bushes are sprayed. The bushes can be pruned after having served their purpose for a few years, and when grown in this manner form a more impenetrable barrier than dadap [*Erythrina*] or *Grevillea*.

Cultivation of Castor.—*Trop. Agriculturist, Peradeniya,* li, no. 5, November 1918, pp. 297–301.

In this paper which forms Leaflet No. 11 of the Department of Agriculture the following pests of the castor-oil plant in Ceylon are recorded.—*Dichocrocis punctiferalis*, Gn., the caterpillars of which attack the fruit capsule or flower-shoot, within which they pupate; *Achaea (Ophiusa) melicerta*, Dr., the caterpillars of which feed on the leaf, a few individuals being capable of completely defoliating a tree, and the total life-cycle of which occupies from 23 to 62 days; *Empoasca flavescens*, F. (green fly), which causes curling and distortion of the leaves, but is not very destructive to plants grown as a field crop on a large scale. Other insects which do damage as leaf-feeders are:—*Prodenia litura (littoralis)* (tobacco caterpillar) and *Ergolis taprobana* (castor butterfly).

In some parts of India dusting the plants with ashes is practised as a preventive measure, this being practicable only on a small scale. As the large-leaved varieties have proved more immune to attack, the planting of these is recommended where large areas are devoted to this plant.

Black-headed Caterpillar of Coconuts (*Nephantis serinopa*).—*Trop. Agriculturist, Peradeniya,* li, no. 5, November 1918, p. 308.

The only practical way of dealing with the Microlepidopteron, *Nephantis serinopa*, a pest of tall palms, is to remove the affected fronds and leave them on the ground for 3 weeks, thereby checking the pest and at the same time allowing its Hymenopterous parasites to complete their development. Probably the same result could be obtained with less injury to the palms if only the pinnae were cut off, leaving the centre ribs.

The Pink Boll Worm at Barbados.—*Agric. News, Barbados,* xvii. no. 433, 30th November 1918, pp. 376–377.

A mixed cargo of cotton seed and cassava that recently arrived at Barbados from Para, Brazil, was refused landing owing to the cotton seed being infested with *Pectinophora (Gelechia) gossypiella* (pink bollworm), several adults of which were found in the hold. A small part of the cargo, other than cotton, that had been landed was reshipped, it being probable that the whole cargo would be transhipped in the bay for ultimate conveyance to England. In such a case even when

permission to land the cargo has been withheld, there still exists the danger to growing cotton due to moths reaching the shore by flight from the place of anchorage.

The question has arisen as to whether the existing legislation is sufficiently effective to deal with such a case, and it is urged that if this is not so, immediate steps should be taken to render it adequate.

RAMAKRISHNA AYYAR (T. V.). **Some Notes on the Habits and Life History of the Stem Weevil attacking Cambodia Cotton** (*Pempheres affinis*, **Faust**).—*Madras Agric. Dept. Year Book 1918*; *Madras*, 1918, pp. 1–13, 4 figs. [Received 6th January 1919.]

Pempheres affinis (stem weevil), the most important pest of Cambodia cotton, occurs in widely distant areas, such as Behar in North India, and Coimbatore in South India, without being found in the intervening districts. The larva bores into the stem just above ground-level, causing gall-like swellings. When young plants are attacked they usually die, but plants 4 or 5 months old may survive, though they are liable to be bent by a strong wind, or they may dry up altogether, the loss in bad cases being from 15 to 20 per cent. of the normal crop.

The whole life-cycle is passed on the plant itself. The egg, which is deposited just beneath the thin bark of the stem, hatches in 9 to 10 days, as many as 7 or 8 eggs sometimes occurring in one stem. The larval period is approximately a month to a month and a half, during which time the larva cuts irregular tunnels beneath the bark, though these do not extend far up the stem. The pupal stage lasts for 9 or 10 days, but the adult remains a day or two longer within the stem before emerging. The adult lives for from 25 to 30 days, the time required for the completion of one generation being about two months. No natural enemies, either parasites or predators, have as yet been discovered. The weevil has been found to a slight extent on *Hibiscus cannabinus* (gogu) and on *H. esculentus* (bhindi) and at Pusa has been found breeding on a wild plant, *Triumfetta* sp.

In the Coimbatore district Cambodia cotton is grown right through the year, or even longer, allowing the weevil to breed continuously all the year without a break. Since there is a possibility of 6 generations a year, the rapid multiplication of the pest is explained. There does not appear to be any period of hibernation or aestivation. All remedial measures must be of a preventive nature, but some of these, such as smearing the base of the stem with dilute phenyl, or earthing up the stem with a mixture of loose soil and powdered lead arsenate, have proved useless, while the plucking and burning of badly infested plants have given good results only when practised by all cultivators in one area. Legislation requiring a close season for cotton growing, during which no cotton plants would be found in a whole district, would do much to eliminate this pest by starvation.

MCSWINEY (J.). **Report of the Agricultural Department, Assam, for the Year ending 30th June 1918**, *Shillong*, 1918, pp. 5–6. [Received 7th January 1919.]

The most common and serious pests of rice in Assam are *Hispa armigera* (rice Hispid), *Leptocorisa varicornis* (rice bug) and *Schoenobius incertellus* (*bipunctifer*), remedial measures that have been attempted

not having had very encouraging results owing to lack of concerted action and natural difficulties. The mustard aphis caused considerable damage, but was controlled in a small area by spraying with crude oil emulsion. Jute was attacked by *Diacrisia obliqua* and *Cosmophila (Anomis) sabulifera,* measures against which were only partially successful. In one district borers in sugar-cane are being effectively controlled and several new borers in citrus trees have been sent to Pusa for identification.

MOORE (W.). **Observations on the Mode of Action of Contact Insecticides.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, pp. 443–446.

In a recent paper on the physical properties governing the efficacy of contact insecticides [see this *Review,* Ser. A, vi, p. 397] it was shown that fat solvents, oils and soaps were able to penetrate the tracheae of insects by capillarity. It was also noticed that heavy, practically non-volatile and non-toxic oils that had thus penetrated the tracheae caused the death of the insects, but that the tissues of such insects were not stained by trypanblue until ten, twenty or more hours had elapsed. The question then arose as to whether the insects did not die from lack of oxygen resulting from the closing of the tracheae.

Experiments with contact insecticides containing oil or soap, which are detailed in this paper, show that such an insecticide may penetrate the tracheae of the insect, thus preventing normal oxidations from taking place in the insect's body, with the result that the insect dies from their mechanical action alone. It is necessary, if death is to be insured, that all the tracheae be filled with the spray. The vapour of the insecticide, such as nicotine, may produce death by chemical action without materially influencing the intake of oxygen. For small insects, such as Aphids, an insecticide killing in a mechanical way alone will give good results, since all or nearly all the trachea will be filled. For larger insects, such as *Lygus pratensis,* L. (tarnished plant bug), it is not likely that all the tracheae would be filled and therefore it would be necessary to add to the spray an insecticide capable of killing in a chemical manner in order to ensure death even if only one trachea were filled. The efficacy of free nicotine sprays is found to be increased, sometimes by 50 per cent., by the addition of soap.

In studying the effect of laundry processes upon the active stages of *Pediculus humanus* (*corporis*) (clothes louse), it was found that this insect is able to close its tracheae quickly enough to keep out soap solutions, lubricating oils, oxylene, and frequently even ether. *Haematopinus suis* (hog louse) and *H. piliferus* (dog louse) have the same power in a less degree. *Ctenocephalus canis* (*Pulex serraticeps*) (dog flea), *Pseudococcus* (mealy bug), *Coccus* (soft scale), *Musca domestica* (house-fly), larvae and adults of *Sitotroga cerealella* (Angoumois grain moth), larvae of *Hemerocampa* (*Notolophus*) *leucostigma* (tussock-moth) and *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt. (pea aphis) were all found to be unable to prevent the penetration of ether, but it does not follow that some of these might not be able to shut out heavy oils or soap solutions. If parasitic lice, ticks, etc. should be

found to possess the ability to close the tracheae rapidly it will have considerable bearing upon the type of dips that will prove most effective. It is hoped that further attention may be given to this problem.

DAVIDSON (W.M.). U.S. Bur. Entom. **The California Pistol Case Bearer,** *Coleophora sacramenta,* **Heinrich.**—*Jl. Econ. Entom., Concord, N.H.,* xi, no. 6, December 1918, pp. 446–452. 1 plate.

Coleophora sacramenta, Heinrich (California pistol case-bearer) is one of the Elachistid moths, a number of which are injurious to deciduous fruit trees. Allied species are *C. fletcherella,* Fernald, (cigar case-bearer), *C. volckei,* Volck, (Western cigar case-bearer) and *C. malivorella,* Riley (Eastern pistol case-bearer). The last-named, which attacks pomaceous fruit-trees in the eastern States, is very similar in appearance and habits to *C. sacramenta,* but the larvae pupate on the twigs and branches instead of on the leaves as in the case of *C. sacramenta*; the egg and pupal instars of *C. malivorella* in New York are passed in from 10 to 14 days, while those of *C. sacramenta* in California require about 25 days.

There is one generation of *C. sacramenta* in California in a year. The moths begin to appear about the middle of May and are present until mid-July. How long they live is not known; in cages they existed for a week without food. The food-plants include plum, prune, cherry, apricot and apple, especially plum and cherry. Eggs are deposited on both sides of the leaf but mostly on the upper surface. These hatch during June and July after an incubation period of about 26 days. The young larvae upon hatching bore into the leaf underneath the eggshell and begin to construct a case, and while working under this they skeletonise the leaf, moulting once during this period. In September they move to the twigs and limbs to which they attach their cases for hibernation, and remain dormant until the following February or March. A large percentage of the larvae die during the dormant period. About the time when the buds are swelling in spring the larvae resume activity, eating first the unopened buds and later the young foliage as it appears. When full-grown, and after one or perhaps two moults, the larvae fasten their case to the leaf-surface and pupate, this generally occurring in April and May. After 25 days the adult moths split the butt-end of the pistol-shaped case and emerge. A description of each stage is given.

The caterpillars are frequently parasitised by a Pteromalid, *Eurydinota flavicorpus,* the parasitism generally not being evident until the larva is nearly mature. There are frequently from 10 to 20 parasites in a case and these issue at the time when the last moths are emerging.

CHITTENDEN (F. H.). **The Lotus Borer.**—*Jl. Econ. Entom., Concord, N.H.,* xi, no. 6, December 1918, pp. 453–457, 1 plate.

Much confusion has occurred between *Pyrausta penitalis,* Grote (lotus borer) and *P. nubilalis,* Hb. (European cornstalk borer), and it is hoped that this account of the former moth will serve to differentiate it from allied species. The observed food-plants of *P. penitalis*

are lotus (*Nelumbium luteum*), *Polygonum*, *Apocynum* and *Eupatorium*, and although the larvae have been found in considerable numbers in raspberry canes and boring in maize stalks, study of the insect's habits has shown conclusively that serious injury does not occur to any plant other than the lotus. The distribution of *P. penitalis* in the United States is from New Jersey westward to Illinois and Kansas and southward to Texas. The life-history has been worked out approximately. Hibernation occurs in the larval stage, the first moths emerging from March until June, according to the locality. The eggs and place of oviposition have not been observed. The larva is first found on the upper surface of the leaves in a silken, tent-like web, but soon turns its attention to burrowing, perforating and devouring buds and seed capsules and the interior of stems that are available. It feeds and develops during the summer and towards the end of August crawls into any convenient stem for hibernation, a cocoon being constructed with a little silk. The insect is parasitised by a number of Tachinids, including *Panzeria penitalis*, Coq., which had destroyed more than half the larvae collected by the author from raspberry stems, *Exorista vulgaris*, Fall., *Hypostena variabilis*, Coq., and *Phorocera comstocki*, Will. An Ichneumonid, *Zemelucha* (*Porizon*) *facialis*, Cr., was reared with the first-named. *Bracon xanthostigmus*, Cr., has been reared more than once from blackberry canes. Another Braconid and a Chalcidid parasite have also been recorded, the latter being a secondary parasite of the former. Blackbirds are said to eat many of the larvae before they seek their winter shelter.

A spray of lead arsenate, Paris green or other arsenical will destroy the young larvae before they penetrate the interior of buds, seed capsules, etc. When they are working within these shelters, it is better to pick off the infested portions and burn them. It is advisable also to collect and burn the stalks in which the insects are found late in the season. When the pest occurs on lotus, all parts of the plant containing the insect above the water line should be cut away.

RUST (E. W.). *Anastrepha fraterculus*, **Wied. (Trypetidae), a Severe Menace to the Southern United States.**— *Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, pp. 457–467.

Numerous Trypetids are serious pests of fruit in almost all tropical or sub-tropical countries. In northern Argentina the particular species dangerous to fruit is *Anastrepha fraterculus*, Wied., and this would become a very serious pest if once it gained entrance to the southern United States. This species is indigenous to, and well distributed over the warmer portions of South and Central America and the West Indies. The Province of Tucumán has suffered the severest infestation, oranges being seriously damaged in that region, while almost all thin-skinned fruits are more or less liable to infestation in most parts of Northern Argentina. In the Provinces of Salta and Jujuy almost every orchard visited during May was found to be infested, and it is considered that before many years the wild oranges in the forests of these regions will be regular host-plants of the fly.

The female oviposits in many kinds of fruit, in various stages of maturity and at various seasons. The eggs are sometimes placed singly but frequently several occupy the same cavity and one fruit

may be covered with the scars of many ovipositions by different females. These eggs hatch after from 2 to 4 days, the larvae immediately beginning to eat their way into the fruit. In summer the larval period averages from 12 to 15 days; this may be prolonged to several weeks in winter. When fully developed the larvae leave the fruit and burrow into the soil to a depth of 2 or 3 inches, where they pupate. If burrowing is not practicable, the pupa may be situated under any convenient object or even in an exposed position. The pupal period varies from 12 days to several weeks according to the temperature. The adults normally feed on fruit-juices, sap or honey-dew. If supplied with food they have been kept alive for more than three months, and this period may be greatly prolonged under favourable conditions. Mating frequently occurs on the first day after emergence, oviposition usually beginning about the seventh day or earlier and continuing for a long period, an average female probable depositing between 500 and 800 eggs.

The fruits attacked and more or less completely destroyed by *A. fraterculus* include: Guava (*Psidium guajava*), coffee berries, pear, peach, mango, orange, *Eugenia* spp., *Phylocalyx*, Japanese plum, Japanese persimmon, Pará plum, and *Anona humboldtiana*. In addition, the author has found infested in northern Argentina, strawberry guava (*Psidium cattleyanum*), Chinese guava (*P. lucidium*), fig (*Ficus carica*), pomelo (*Citrus decumana*), kumquat (*Citrus japonica*) tangerine (*Citrus nobilis*), apricot (*Prunus armeniaca*), avocado (*Persea americana*), chirimoya (*Anona cherimola*). Lemons have several times been found punctured by the fly, though no larvae have been known to develop in them.

In Argentina, apricots are first attacked in the spring, and then peaches, which may be regarded as the principal summer host of the insect. Both adults that have survived the colder months and those that have emerged from hibernating larvae or pupae oviposit in early apricots and rapidly develop, giving rise to more adults that are ready to attack the first peaches, many of which are punctured when not much more than half-grown. These peaches mummify and sometimes drop but do not furnish nourishment for the larvae to develop. In fruit that is attacked two or three weeks before ripening, the larvae develop rapidly, eating out a large part of the flesh and causing the remainder of the peach to rot. If the fruit falls the larvae generally complete their development in the fruit as it lies on the ground. The life-cycle may be completed in about three weeks in summer under favourable conditions of food and-temperature, though the usual time is about 30 days. By the end of the peach season, the flies have reached their maximum number and there is scarcely enough fruit for all the females to oviposit in, with the result that any kind of fruit is used for this purpose although the larvae can only develop in certain kinds. After the peaches have all been destroyed, later fruits such as chirimoyas and guavas each serve as host for one generation of the insect. Persimmons help the flies to survive until oranges are ripe for attack, which is generally from early March until the end of April. Numbers of eggs deposited in oranges are destroyed by the essential oils liberated in the orange peel by the puncture of the fly, while many larvae starve to death before they can penetrate the thick rind and reach the pulp that they require for nourishment.

Fruits punctured by *A. fraterculus*, even if no oviposition takes place, are frequently destroyed by *Colletotrichum* and other fungus spores or by bacterial rot. The growth of larvae of *A. fraterculus* in citrus fruits is slower than in the other fruits mentioned, partly owing to the qualities of the fruits themselves and partly to the lower temperature in autumn and winter when these fruits are ripening. During the coldest weather development ceases entirely and the season is spent in a quiescent state by both larvae and pupae, though the adults may continue active on warm days throughout the winter.

If climatic conditions have been favourable to a heavy crop of early fruit, fruit-flies are abundant, and consequently when oranges are ripe they become heavily infested. Unfavourable weather occurring early in the season may severely check the flies without seriously damaging the fruit-trees and thus a good crop of comparatively clean fruit results. It has been found that neither frost nor rain has much adverse effect upon *A. fraterculus*, but heat and drought occurring together are a considerable check to the fly. Moreover, such conditions will produce a small crop of fruit, with the result that the fly will be checked in its multiplication and the fruit of the succeeding season will be comparatively free. Many larvae and pupae are killed outright by heat, and with a temperature much over 100° F., larvae are often cooked in the fruit that falls in the sun before they can escape and enter the soil. Such a temperature is fatal also to emerging flies.

Very few parasites of *A. fraterculus* have as yet been found in Argentina, and these were all the same undetermined species of Ichneumonid. Other parasites have been reported in Brazil. Some of the parasites of *Ceratitis capitata* could doubtless be used to advantage against the South American fruit-fly, but trials have not yet been made. Artificial measures against *A. fraterculus* have not hitherto proved very successful. Clean cultural methods, the destruction of infested fruit, capture and destruction of adult flies, and the use of poison sprays are all helpful in control but need to be practised with co-operation to give any great measure of success. Poison sprays are to be given a more extensive trial during the coming year.

WEISS (H. B.) & NICOLAY (A. S.). **The Life-History and Early Stages of *Calophya nigripennis*, Riley.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, pp. 467–471, 1 fig.

The Psyllid, *Calophya nigripennis*, Riley, appears to live exclusively upon *Rhus copallinum*, and is found from Connecticut southward to Georgia and Florida. It is fairly abundant in New Jersey although it does not occur in every place where its food-plant grows. In some localities heavy infestations of *C. nigripennis* have occurred without much visible injury to the food-plant. Adults appear about mid-May in the south of the State and about a week later in the north and occur in diminishing numbers up to early July. Oviposition usually takes place on the foliage at the tips of the twigs, and on the edges of young leaves, from 2 to 40 eggs being found on a single small leaflet. The incubation period is from 2 to 3 weeks, the first stage nymphs appearing in middle or late June. There are 4 nymphal stages, each lasting about a month. Towards the end of September practically all the nymphs

have sought hibernation quarters on the woody stems, being then in the 3rd and 4th stages. There is therefore only one generation in a year, development being very slow. All stages of the insect are described.

Parshley (H. M.). **Three Species of *Anasa* Injurious in the North. (Hemiptera, Coreidae [Pentatomidae]).**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, pp. 471–472.

Anasa tristis, DeG. (common squash bug) was until recently the only species of the genus known to occur in New England. In 1914, *A. repetita*, Heid., was reported from Massachusetts and subsequently this species was observed in large numbers on star-cucumber. Recently it has been known to feed on cultivated cucumber in sufficient numbers to have caused injury if hand-picking had not been employed as a preventive measure. The same record applies to *A. armigera*, Say, this species being so numerous on cultivated cucumber in mid-August that some plants were destroyed. These two species are evidently increasing in New England and are likely to become seriously injurious to Cucurbitaceous vegetables, cucumber evidently being the preferred food. Control measures that are used for *A. tristis* should be employed, and in addition the eradication of star-cucumber (*Sicyos angulatus*) is advised. A key is given for the differentiation of these three species, with the date of their occurrence in New England.

Littler (F. M.). **Notes from Tasmania.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, pp. 472–475.

Aegeria tipuliformis, Clerck (currant clearwing moth) has been increasing in Tasmania during the past few years on red, white and black currant bushes, but has not yet been observed in the southern half of the Island [see this *Review*, Ser. A, vii, p. 48]. An Ichneumonid parasitic upon it is fairly abundant and does not appear to be hyper-parasitised; it may therefore be an effective check. The destruction of all badly affected currant bushes, the vigorous pruning of bushes during the winter in affected plantations and the burning of all parts cut away, care in selecting cuttings for striking, and spraying the bushes with lead arsenate immediately after the fruit has been picked, have produced satisfactory results.

As a consequence of the unusually rainy season of 1916–17 there was a super-abundance of plant growth and many pests were numerous, *Nysius vinitor* (Rutherglen bug) being particularly abundant. Early in the year the immature insects were migrating in countless numbers from an area of reclaimed land in Launceston into a park in one direction and along the gutters of the public streets in another. Steps were then taken to isolate the breeding ground with coal-tar barriers. The migration of further immature forms to the park was checked by spraying, and the weeds on the breeding area were cut and burnt. A large number, however, escaped and it is feared that in the coming spring the insect will be very abundant. Only two instances of damage were reported, once to garden plants and once to tomatoes.

Cydia (*Carpocapsa*) *pomonella* (codling moth) has only one generation in a year in Tasmania, but the hatchings are extended over a long period. Lead arsenate has almost entirely superseded Paris green

as a poison spray, and this insecticide, with improved spraying methods, has greatly reduced the destruction caused by the moth. Heavy penalties are inflicted upon persons attempting to sell infested fruit. Much discussion has taken place regarding the best time for the first spray. In the author's opinion this should be prior to the closing of the calyx lobes, and should be followed by a second and third application in order to protect the fruit from later-hatching larvae. The common earwig, *Forficula auricularia*, L., causes a good deal of damage in flower gardens and in kitchen gardens, but is beneficial in that it destroys many larvae of *C. pomonella* under bands.

Dindymus versicolor (harlequin fruit-bug), in common with other Rhynchota, was very abundant during 1916–17. Red, white and black currants were punctured at the bases of the stalks and fell before they were ripe. Some of the softer varieties of apples were injured in the same manner. After all soft fruit was picked, sunflower and artichoke stems were attacked. Boiling water was usually most effective in dealing with swarms of this bug. Those on plants and flowers were dealt with by jarring into hot water or water covered with a film of oil.

YOUNG (A. W.). **The Development of a Portable Insectary.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, pp. 476–479, 1 plate.

As a result of four years' practical experience a portable insectary has been constructed that is considered to be an ideal shelter for entomological work. The structure is designed to be strong, simple and portable, of sectional construction, made of non-conducting material with a continuous ventilating space from the eaves to the ridge between the outer and inner walls. The construction of this building is fully described, with a drawing showing the details, and a blueprint would be furnished to anyone desiring to build such an insectary. The cost of the materials is approximately £20, and it is estimated that a carpenter and one assistant could build the structure in six days.

DE ONG (E. R.). **Flies Associated with a Grasshopper Outbreak.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, p. 480.

Bombyliid flies, especially a species of *Anthrax*, were observed in great abundance in early September, 1918, in certain localities of California where grasshoppers have been very plentiful for the last two years. These flies have been known to check grasshopper outbreaks in previous years by the depredations of the larvae upon the grasshopper eggs.

DE ONG (E. R.). **Insect Pests of the Castor Bean.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 6, December 1918, p. 480.

Castor beans have been grown for the first time in quantities in California in 1918, and are serving as host-plants for many common insects, such as cutworms, and a species of *Blapstinus* that feeds on the stems of the young plants and attacks tomatoes in the same

way. *Laphygma flavimaculata,* Harv. (beet army-worm) attacks the leaves, the young larvae feeding beneath a protecting web on the upper leaf-surface.

SNAPP (I.) & STAFFORD (E. W.). **The Common Cricket, *Gryllus assimilis,* as a Cotton Seed Pest.**—*Jl. Econ. Entom., Concord, N.H.,* xi, no. 6, December 1918, pp. 480–481.

Early in September, cotton seed in newly opened bolls in Mississipi was found to be damaged by *Gryllus assimilis,* F., var. *luctuosus,* Serv. (large black ground cricket), which cut away the seed hull and ate the contents. The unusually dry season and consequent scarcity of vegetation that forms the regular food of these insects may have driven them to attack the cotton. It was estimated that 10 per cent. or more of the seed was destroyed by this pest.

HOWARD (L. O.). ***Gracilaria zachrysa,* Meyr., attacks Apple Foliage in North-western India.**—*Jl. Econ. Entom., Concord, N.H.,* xi, no. 6, December 1918, p. 482.

The author communicates information received from the Imperial Entomologist at Pusa, India, to the effect that *Gracilaria zachrysa,* Meyr., has been observed in the larval stage attacking apple leaves in North-west India and has also been recorded on apples in Assam. Probably this moth occurs in all the apple-growing districts along the Himalayan region, where the winter is severe. In view of the recent introduction of this pest into the United States of America on azaleas from Japan this information is important in case the pest should become acclimatised and turn its attention to apples in that country.

Locust Extermination.—*Philippine Agric. Review, Manila,* xi, no. 2, second quarter 1918, p. 65. [Received 7th January 1919.]

The Philippine islands are now free from locust invasions and have been so for a period of several months. On 28th July 1917 the Archipelago was declared free of locusts, and except for a few scattered swarms that were promptly destroyed upon their appearance, the country has been free ever since. No locust swarms since 22nd September 1917 have been reported anywhere in the Archipelago, a condition that has not occurred before during modern times.

DE JOANNIS (J.). **Sur la Présence en France de *Grapholitha leplastriana,* Curtis, Microlépidoptère dont la Chenille est nuisible au Chou cultivé.** [The Occurrence in France of the Microlepidopteron, *Grapholitha leplastriana,* the Caterpillars of which injure the cultivated Cabbage.]—*Bull. Soc. Entom. France, Paris,* 1918, no. 17, 13th November 1918, pp. 234–237.

The occurrence of *Cydia* (*Laspeyresia*) *leplastriana* is recorded on cabbages from the agricultural region of Niort, where its depredations may result in much loss. It has rarely been reported from France, though its presence in Austria and England is well established. In the latter country it occurs near Dover on *Brassica oleracea* (sea

cabbage), wild cabbage being its usual host-plant, and also readily adapts itself to the cultivated variety. At Fano, Italy, the larvae attack cauliflowers, destroying the tips of the young plants. The insect has two generations annually, the adults appearing in July and September. In England there is only one generation, in July and August. The method of preventing loss by late sowing has proved impracticable.

VAYSSIÈRE (P.). **Existence en France du *Diaspis pentagona*, Targ. (Hem. Coccidae).** [The Occurrence of *Aulacapsis pentagona* in France.] — *Bull. Soc. Entom. France, Paris,* 1918, no. 18, 27th November 1918, pp. 242–243.

Aulacaspis (*Diaspis*) *pentagona*, the dangerous pest of the mulberry in silk-growing countries, is widely distributed in Italy, where its host-plants number 54 species, chiefly fruit trees and ornamental plants, such as the apricot, almond, bignonia, cherry, cherry-laurel, lilac, etc., and many control measures have been instituted there, including the propagation of *Prospaltella berlesei*, How.

In France, legislation and careful inspection have hitherto prevented its entry, but since August 1918 it has been reported from several points just across the Italian frontier, having probably entered on vegetables introduced during the war by routes other than those subjected to official inspection.

Essais de Destruction de la Cochylis et de l'Eudémis par des Champignons parasites. [Attempts to control *Clysia ambiguella* and *Polychrosis botrana* by means of parasitic Fungi.]—*La Vie Agric. et Rur., Paris,* ix, no. 1, 4th January 1919, pp. 19–20.

Attempts have been made to control *Clysia ambiguella* and *Polychrosis botrana* by means of the fungi, *Spicaria farinosa* var. *verticilloides* and *Botrytis bassiana*, but without success in the field during the vegetative period, though some positive results have been obtained in the laboratory.

Experiments have shown that the mode of infection is not always the same; sometimes it is by penetration of the integument of the insect, sometimes by way of the digestive tube, sometimes by obstruction of the respiratory tract. Further, every epidemic of fungous origin is controlled by external conditions, insect-infesting fungi being practically inoperative in summer, a time when the resistance of insects is at a maximum, while a moist state of the atmosphere hinders the germination of the spores and the growth of the mycelium.

It has not been found possible to infect these two moths with *Nosema bombycis*.

RITZEMA BOS (J.). **Insektenschade in het Voorjaar 1918.** [Insect Injury in Holland in the Spring of 1918.]—*Meded. Landbouwhoogeschool, Wageningen,* xv, no. 2, 1918, pp. 68–74. [Received 2nd January 1919.]

Damage by insects was very marked in the spring and early summer of 1918 owing to the prolonged dry weather, to the early occurrence

of warm weather and to the cultivation of grassland. Beans were grown on a very large scale and this must have encouraged the increase of *Phorbia* (*Anthomyia*) *cilicrura*. Oats, barley, wheat, potatoes, cabbage, peas, beans, etc., were attacked by Elaterid larvae, chiefly, though not exclusively, on former pasture land. Beet-fields were infested by the larvae of *Silpha atrata*. Raspberries were injured by the raspberry beetles, *Byturus fumatus* and *B. tomentosus*. *Meligethes aeneus* was particularly injurious to flowering radish plants. *Otiorrhynchus tenebricosus* injured fruit trees, retarding the development of young shoots and foliage, while *O. singularis* damaged raspberry, apple, pear and grape-vine. *Cneorrhinus plagiatus* (*geminatus*) attacked French beans, and *Sitones lineatus* young peas and beans and in one district severely injured clover, which is unusual. *Cryptorrhynchus lapathi*, which normally infests willows and poplars, was observed boring in pear twigs and *Anthonomus pyri* injured pear buds, while *A. pomorum* was very harmful in many localities. Flea-beetles of the genus *Phyllotreta* did much damage to melons, cucumbers, turnips and radish. *Psylliodes chrysocephala*, which had decreased with the diminished cultivation of rape-seed in Groningen, has reappeared.

The saw-fly, *Pteronus ribesii* (*Nematus ventricosus*), did much damage to gooseberries, while *Lygaeonematus pini* (*N. abietum*), or a closely-allied species, attacked *Picea excelsa* and *Picea pungens glauca*. *Hoplocampa testudinea* injured young apples; this saw-fly is more common than is usually supposed, much of the damage it does being ascribed to *Cydia pomonella*. Rose leaves were curled by *Blennocampa pusilla*. *Lophyrus rufus* appeared to have increased considerably. The larva of a species of *Cephus* was found boring in young raspberry shoots.

Lepidopterous pests included *Malacosoma* (*Gastropacha*) *neustria*, of which a great increase was noted. The caterpillars of *Olethreutes urticana* and *Sparganothis* (*Tortrix*) *pilleriana* severely attacked strawberries, while *Depressaria heracleana* injured the inflorescences of parsnips. *Coleophora laricella* seriously damaged larches.

Injurious Diptera included Tipulid larvae attacking cabbage, which also suffered severely from the larvae of *Phorbia* (*Anthomyia*) *brassicae* and *P.* (*A.*) *cilicrura*. *P.* (*A.*) *platura* injured shallots, onions and leeks, while lupin seedlings were destroyed by *P.* (*A.*) *funesta*. The weather in spring was very favourable to Aphids, and in many localities beans were heavily infested by them. The Coccid, *Pulvinaria betulae*, attacked birch and, in one instance, peach.

SCHOEVERS (T. A. C.). **Proeven met eenige Chemicaliën ter Bestrijding van het Wortelaaltje, *Heterodera radicicola*, Greef.** [Trials with some Chemicals in the Control of the Nematode, *H. radicicola*.]—*Meded. Landbouwhoogeschool, Wageningen*, xv, no. 2, 1918, pp. 85–88. [Received 2nd January 1919.]

These experiments confirm the value of lime and sulphate of ammonia against *Heterodera radicicola*, as reported on a previous occasion [see this *Review*, Ser. A, v, p. 277], and it was also found that formalin ($1\frac{1}{2}$ per cent. of the commercial article) gave equally good results. Naphthaline and carbolineum were also of some value.

STAHEL (G.). **Over een Schorskevertje, *Xyleborus perforans*, Woll., in de Liberia-Koffie.** [*Xyleborus perforans*, a Bark-Beetle infesting Liberian Coffee.]—*Departement van den Landbouw in Suriname, Paramaribo,* Mededeeling no. 8, 9th March 1917, 3 pp. [Received 20th January 1919.]

In February 1917 about 150 Liberian coffee bushes in a plantation in Dutch Guiana were attacked and in part killed by a beetle identified as *Xyleborus perforans*, Woll., which infests growing sugar-cane in the East and West Indies. The injury occurred in a plot of $3\frac{1}{2}$-year-old plants where the *Erythrina* shade-trees had lately been pruned. The older leaves become yellow and fall, and ultimately the younger leaves also become affected. Examination of the bark reveals the bore-holes, which measure about 1 mm. in diameter and are found about 8 inches from the ground in plants showing the first symptoms of infestation, while in later cases they may be found as high as 24–32 inches from the ground and also in the larger roots. To prevent the spread of this pest the infested plants were dug up and burnt and the adjacent healthy bushes were smeared with coal-tar at the base of the stem.

DEL GUERCIO (G.). ***Oxycarenus hyalinipennis*, a Hemipteron Injurious to Cotton, in Italian Somaliland.**—*Agricoltura Coloniale, Florence,* xii, no. 3, 1918, pp. 147–166, 23 figs. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* ix, no. 10, October 1918, p. 1262.) [Received 14th January 1919.]

Oxycarenus hyalinipennis oviposits inside cotton bolls not far from the seeds, and also on the tracts surrounding the bolls as well as at their base, the larvae in the first case feeding on the seeds, and in the latter attacking the basal walls.

The sporozoa, *Pissidocystia oxycarenidis*, gen. et sp. n., and *Valvicystia rhopaloides*, gen. et sp. n., have been found in the viscera of nymphs and adults of *O. hyalinipennis.*

BRÈTHES (J.). **Sobre algunos Himenópteros útiles del Sud del Brasil.** [Some useful Hymenoptera of Southern Brazil.]—*Anales Soc. Rural Argentina, Buenos Aires,* lii, no. 1, January 1918, pp. 7–11, 2 figs. [Received 17th January 1918.]

From a number of Hymenopterous parasites sent from Rio Grande, Brazil, the following new species are described.—*Lytopilus melanocephalus*, parasitic upon an undetermined Lepidopteron injurious to lucerne, perhaps *Colias lesbia*; *Aphidius brasiliensis*, parasitic upon Aphids; *Heptasmicra brasiliensis*, parasitic upon *Oeceticus*(?); *Heteroscapus ronnai*, gen. et sp. n., parasitic upon the larva of an undetermined Lepidopteron, this genus being related to *Baryscapus*; and *Tetrastichus isis*, parasitic upon *Oeceticus* (?).

MASSINI (P. C.) & BRÈTHES (J.). **El Gusano de los Naranjos. Su Enemigo natural *Pteromalus caridei*, Brèthes. Su Clasificación y Utilización biológica en Defensa de los Naranjales.** [The Orange Caterpillar; its Natural Enemy, *Pteromalus caridei*, Brèthes; its Classification and Biological Use in Defence of Orange Trees.]—*Anales Soc. Rural Argentina, Buenos Aires,* lii, no. 2, February 1918, pp. 73–76, 2 plates. [Received 17th January 1919.]

Papilio thoas thoantiades, Burm., is a serious pest in plantations of Aurantiaceae. Throughout the summer the eggs of this butterfly

can be found on the young leaves of oranges, lemons and similar plants. The various stages are described. Many of the pupae are parasitised by a small Chalcidid, *Pteromalus caridei*, which deposits many eggs, as many as 20 being found within one pupal case. This parasite is evidently a very effective check, as 98 per cent. of individuals of *P. thoantides* collected were found to be attacked. As this parasite attacks *P. thoantiades* exclusively, there is no danger in liberating it wherever this butterfly is troublesome, while the collection of parasitised pupae and the subsequent rearing of the parasite from them is a simple matter. It is not definitely known whether the butterfly is attacked in its larval or pupal stage, but probably in both, though the parasites have always been found within the pupa. The adult of *P. caridei* is described, and the importance of protecting and propagating it wherever *Citrus* is cultivated is pointed out.

BRÈTHES (J.). **La Polilla del Grano, *Sitotroga cerealella*.** [*Sitotroga cerealella*, a Grain Pest.]—*Anales Soc. Rural Argentina, Buenos Aires*, lii, no. 10, October 1918, pp. 683–685, 6 figs. [Received 22nd January 1919.]

To the grain pests of South America previously recorded [see this *Review*, Ser. A, vi, p. 548] the author adds an account of *Sitotroga cerealella*, Ol. The biology and habits of this moth are described and the methods of fumigating against it with carbon bisulphide, carbon tetrachloride and sulphurous anhydride given in the previous paper are recapitulated.

L'Agriculture suisse en 1916. [Swiss Agriculture in 1916.]—*Annuaire Agricole de la Suisse, Berne*, xix, 1918, pp. 266–285.

In the Canton of Valais *Clysia ambiguella* was more in evidence than elsewhere. Fruit tree pests included *Anthonomus pomorum*, *Hyponomeuta malinellus* and *Cheimatobia brumata*.

TREHERNE (R. C.). **Insect Control Work in British Columbia.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 10, October 1918, p. 579.

Since 1900 there have been about 12 distinct and separate outbreaks of codling moth [*Cydia pomonella*] in British Columbia originating in imported fruit, cars, or settler's effects. Seven of these outbreaks were eradicated in from 1 to 2 years, other large ones taking longer, the cost ranging between £2 and £4 per acre. The inspection system began under an Act passed in 1895 and 1897, the great orchard development taking place after 1909. Previous to this year there were only 8,000 acres of fruit in the whole Province, while at the present day there are 40,000 acres, free from codling moth and San José scale [*Aspidiotus perniciosus*].

MASKEW (F.). **Quarantine Division. Report for the Month of September 1918.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 10, October 1918, pp. 591–592.

The following insect pests were intercepted during the month of September:—From Central America: *Pseudococcus* sp., *Aspidiotus*

cyanophylli and *A. cydoniae* on bananas. From Fiji: Larvae of unindentified weevils in sweet potatoes and yams. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; larvae of *Dacus cucurbitae* in cucumbers; unidentified Coccids on croton leaves. From New Zealand: *Pseudococcus* sp. on an unknown plant. From Nicaragua: *Lepidosaphes beckii* on oranges. From Samoa: *Pseudococcus* sp. on coconut palm. From Oregon: *Cydia pomonella* in apples.

Richards (P. B.). **Notes on Entomology in the Federated Malay States during 1917.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur,* vi, no. 10, July–August 1918, pp. 409–420. [Received 15th January 1919.]

During 1917 large collections of insects, many of which are new to science, have been made throughout the Federated Malay States, and 111 species of insects and 2 of mites have been studied in the laboratory, most of them being of economic importance.

Among rubber pests *Coptotermes gestroi* is still the most important. It is recognised that clean clearing is essential for eradicating this termite, but the condition of affairs in this respect is still far from satisfactory. In time, with universal clearing up of dead wood and systematic treatment of attacked trees it is hoped that there will remain so few centres of infestation that it will cease to be a serious pest. In addition to the direct damage done by this species it is suspected of infecting trees with wood-rotting fungi such as *Poria* and *Ustulina*, and there is considerable evidence that it is frequently responsible for "brown bast" attacks.

The rubber leaf mite is capable, in certain conditions of soil and weather, of doing considerable injury to young rubber-fields. This mite, which is very minute, punctures the epidermis of the young leaves and shoots, and sucks out the fluid cell-contents. The life-cycle requires only 5 to 7 days, and as each female deposits 50 or more eggs, increase is very rapid. The damage to rubber plants varies from distortion of the leaves to repeated defoliation of the young shoots and the ultimate death of the plant. Attacks by the mite are also frequently followed or accompanied by leaf and stem fungus attacks, the mite often passing unnoticed owing to its small size. While this pest is present probably on every estate throughout the Peninsula, it has as yet assumed serious proportions only where root conditions have been unfavourable for the growth of *Hevea brasiliensis*. In such cases the attacks have caused checking, stunting and death of seedlings in nurseries, and weakly and stunted growth in young clearings. Improvement of soil conditions by draining, manuring or cultivation is the first essential of preventive and remedial treatment. Where the attack has become established, spraying with lime-sulphur wash containing two pounds of sulphur per 100 gallons is an effective remedy, acting both on the mites and the fungi. This should be applied twice at ten-days' interval and afterwards once every 3 or 4 weeks in such nurseries and young plants as show signs of re-infestation. A small percentage of rubber trees appears to be resistant to mite attack; in areas known or likely to be mite-infested these might be planted with advantage.

A swarm of caterpillars that proved to be a species of *Spodoptera* attacked a field of young rubber at Kuala Selangor. The district had previously been flooded, after which many caterpillars matured on the rank grass. The moths developing from these oviposited in a new clearing; the young larvae, after eating all the available grass and weeds that constitute their normal food, attacked the young rubber plants and in a few days all the foliage and young green bark was stripped from them. Hand-picking was resorted to as the outbreak was reported too late for poisoning to be tried. Large numbers of swarming caterpillars or army-worms on grass and weeds in the vicinity of rubber should be regarded with suspicion and preparations made to deal with them should their native food supply run short. Various localities have been troubled by a bark-eating caterpillar, the species being unidentified as the larvae would not feed in captivity. The bark, either tapped or untapped, is eaten away, causing small irregular wounds. The caterpillars are not as yet sufficiently numerous to warrant special treatment. Minor pests of rubber leaves include various species of Psychids (bag-worms) and four species of Coccids.

Coconuts are seriously damaged by *Coptotermes gestroi*. It is noticed that after removal of timber that affords breeding-sites for *C. gestroi* there is frequently a marked increase in attack both on coconut and rubber plantations. This is generally due to individuals that have escaped destruction in the logs and have hurriedly constructed a shelter of earth around the trunks. These should be scraped away and destroyed. *C. travians* is frequently found on coconut palms and should be eradicated together with *C. gestroi*, although up to the present no damage can be ascribed to that species.

Oryctes rhinoceros has been effectively reduced in coconut plantations by the destruction of timber and stumps. Digging for the grubs in all likely feeding grounds during wet weather, when they are driven near the surface, has also given much success. The parasitic wasp, *Scolia procer*, Ill., destroys a large percentage of the larvae of *O. rhinoceros*. The Hispid, *Plesispa reichei*, Chap., which was a minor pest in 1914 and 1915, has been increasing both in range and destructiveness. Owing to the larvae and adults living chiefly in the unopened pinnae, treatment with poison sprays is impracticable. Young and weakly palms are chiefly attacked, and in some cases the damage is sufficient to necessitate their removal and the substitution of healthy plants. Hand-picking is expensive and laborious but has considerably reduced the numbers of these beetles.

The coconut spike caterpillar, which is the larva of an unidentified Pyralid, has not hitherto been recorded as a coconut pest, but may prove to be an important one. The male flowers on the spike are attacked first, and when these are all destroyed, the female flowers may be attacked or the caterpillars may migrate to another opening spike. Pupation occurs in a roughly constructed cocoon in which dead flowers are woven in with silk. The infection is sporadic, but may persist for months on a palm, with a resultant loss in crop. It is advisable to cut off and burn all affected spikes in a plantation. The coconut pollen mite frequently attacks the male flowers in large numbers, entering the pollen chambers and feeding on the contents. Much of the pollen is destroyed and the rest becomes massed into heavy

lumps and is probably rendered unfit for fertilisation of the female flowers. Very scanty crops of nuts are obtained from palms infested with this mite, which is frequently found associated with the coconut spike caterpillar. Where treatment is necessary, dusting each spike as it opens with flowers of sulphur, or spraying with lime-sulphur, would probably prove satisfactory. *Brachartona catoxantha* is a recurrent pest, the larvae causing serious damage at intervals of from two to six years. In the interim they are kept in check by parasites, of which a Tachinid fly appears to be the most important, while a fungus, *Botrytis* sp., probably acts as a further check. The caterpillars of *B. catoxantha* eat away narrow strips of tissue on the under-sides of the leaves, all except the youngest leaves of the crown being entirely destroyed in bad infestations. Moreover the wounds in the leaves made by the insect encourage the attacks of leaf fungi, such as *Pestalozzia*. Spraying with a combined insecticide and fungicide might be a successful control measure, but since palms are not apparently killed outright by *B. catoxantha*, it is not known whether the value of the crop saved would compensate for the labour and expense involved in this method. The fact that leaf fungi thrive in wet weather and are not likely to cause much damage during a drought must be considered in deciding whether or not to use a fungicide, while spraying should be regulated by the numbers of parasites present, which differs in different outbreaks. It is therefore impossible to lay down any hard and fast rule for treatment. The larvae of various species of Psychid moths (bag-worms) have occurred as local pests on coconuts and have done much damage in small areas. Treatment consists of hand-picking the cases or poisoning the young caterpillars with a poison spray.

Coffee growers should keep a watch for *Cephonodes hylas* (coffee clearwing moth), the caterpillars of which have been taken frequently on coffee and *Gardenia*.

Ross (W. A.). **The Pear Psylla.**—*Agric. Gaz. Canada, Ottawa*, v, no. 12, December 1918, pp. 1134–1136, 10 figs.

A popular account is given of *Psylla pyricola* (pear psylla), which is frequently very destructive to pear orchards in Ontario. The life-history and nature of the injury are described. The increase of the pest is checked to some extent by several insect enemies, notably Coccinellids, but the most important factor is undoubtedly the weather. Protracted periods of cold, wet weather in spring may be disastrous to the eggs and newly hatched young, while long periods of hot dry weather are fatal to many nymphs. In Ontario it has been found most satisfactory to postpone the so-called dormant application of lime-sulphur (winter strength) until shortly before the trees bloom and then thoroughly drench all parts of the trees including the under-side of the twigs and branches. This destroys the newly hatched nymphs and the eggs about to hatch. Nicotine sulphate, 40 per cent., is added at the rate of ¾ pint to 80 gals. spray mixture applied just after the blossoms fall. This kills the nymphs which are then chiefly in the axils of the leaf-petioles and blossom-stems.

HUDSON (H. F.). **Notes on the Relation of Insect Control to Cultural Practices in Western Ontario.**—*Agric. Gaz. Canada, Ottawa*, v, no. 12, December 1918, pp. 1136–1138.

It is pointed out that with greater crop production and an acute shortage of agricultural labour it is likely that plants will be seriously damaged by insect pests and fungus diseases, and that careful watch should be maintained for these and every effort be made to check their increase. Great importance is attached to methods of farm rotation; several farms under observation have shown little or no sign of insect depredations, while others in close proximity have been distinctly injured. A system that has been followed with excellent results is to plant red clover for hay, to plough this in autumn and plant with wheat. In the spring of the second year clover is again sown on the wheat field and in the following spring the wheat stubble and clover are ploughed under and a good top dressing of barnyard manure given and the ground planted with maize and potatoes. The cultivation through the summer cleans the ground, which in the following spring is planted with oats and then re-sown with clover. Thus two clover crops are turned under in four years. Crops so grown are reported to be always good and free from insect pests and this is attributed chiefly to short rotations of hay crop and the elimination of timothy grass, which has apparently become a very popular crop although it has decided disadvantages.

Entomological Laboratory for Saskatchewan.—*Agric. Gaz. Canada, Ottawa*, v., no. 12, December 1918, p. 1139.

The Entomological Branch of the Canadian Department of Agriculture has established a laboratory and office at the University of Saskatchewan, Saskatoon, which will serve as a headquarters for the work carried on in that Province. Studies on the blood-sucking and other insects affecting live stock will be continued and the laboratory will also serve as a local bureau of information on insect pests affecting crops in the Province, while immediate assistance will be given in the case of sudden outbreaks of insect attack.

SASSCER (E. R.) & DIETZ (H. F.). **Fumigation of Cattleya Orchids with Hydrocyanic-Acid Gas.**—*Jl. Agric. Research, Washington, D.C.*, xv, no. 5, 4th November 1918, pp. 263–268, 2 plates.

During the inspection of orchids prior to the adoption of fumigation with hydrocyanic-acid gas as a requirement for entry, a total of 137 species of insects was collected, principally on species of *Cattleya*, or in cases containing them, during the period from August 1912 to December 1917. These included 41 species of Coccids and a number of recently introduced ants, which are now firmly established and responsible for much injury in greenhouses as far west as Indiana. Examination of three cases of Colombian orchids revealed the presence of 17 species of insects of many orders. A shipment of 47 cases of *Cattleya* from Colombia in 1917 was found to be infested with larvae of an unknown Pyralid moth not known to occur in the United States. Experiments were conducted to determine the possibility of killing these larvae and other insects by the vacuum process without removing

the plants from their original container. As a result of these experiments the Federal Horticultural Board requires that all plants fumigated in the original container must be fumigated with 1 oz. of sodium cyanide with an exposure of one hour. A preliminary vacuum of 20 inches is required prior to the generation of the gas. To determine the penetration of hydrocyanic-acid gas under vacuum conditions experiments were made with *Datana integerrima*, G. & R. (black-walnut caterpillar). The results of fumigation experiments are given in tabulated form. It was found that where excessive dosages are not employed, orchids are apparently stimulated by hydrocyanic-acid gas. Infested orchids at the time of arrival at the port of entry, if in a reasonably good condition, are not seriously affected by hydrocyanic acid gas generated at the rate of 1 oz. sodium cyanide per 100 cu. ft. and are not killed where a 4 oz. dosage is used. Insects that are not hermetically sealed in stems or pseudobulbs of *Cattleya* can be killed in the original cases with hydrocyanic-acid gas provided a 20-inch vacuum is previously effected.

VAN ZWALUWENBURG (R. H.). **Report of the Entomologist.**—*Rept. Porto Rico Agric. Expt. Sta., 1917; Washington, D.C.*, 20th September 1918, pp. 31–34. [Received 17th January, 1919.]

Much of the maize grown in Porto Rico fails to produce seed, and during 1917 the larvae of an undetermined Phorid fly has been suspected of causing this damage. The eggs of this fly are laid in clusters of 25 or more among the strands of the new silk, several such clusters frequently being placed in the tuft of a single ear. The larvae upon emerging from the egg feed on the silk strands, following them downwards. All of the strands may be destroyed in this manner before the silk has been pollinated and as a result very little seed is produced. The work of the larvae also attracts scavenger beetles such as *Carpophilus* sp. and doubtless encourages fungus infection. In June over 75 per cent. of the ears in a field at the Station were found either infested with larvae or with eggs in the silk tuft. The fly is obviously a primary pest and not a scavenger. A Capsid bug was observed to be fairly abundant and to feed upon the eggs of the fly. Investigations are being continued with regard to this pest.

The larvae of a Noctuid moth, *Noropsis hieroglyphica*, feed commonly on the foliage of *Waltheria americana* and have also been reared upon *Morongia leptoclada*. The larvae are gregarious and drop to the ground if disturbed. The oval pupa-case is formed on the stem of the food-plant and covered by grass and bits of leaves.

A heavy infestaton of *Anastrepha fraterculus* (mango fruit-fly) occurred in July in fruits of *Eugenia jambos*. This is the first record of this plant as a host of the fly in Porto Rico. The scale, *Conchaspis angraeci*, is one of the few insects observed upon vanilla, which has only recently been cultivated in the Island; it does not, however, seem likely to become an important pest. A local outbreak of a Noctuid moth, *Melipotis januaris*, occurred in June on guamá (*Inga laurina*); a few days after the appearance of the larvae they had all entered the ground to pupate. Some protection against *Strategus*

quadrifoveatus, a rhinoceros beetle attacking coconuts, seems to be afforded by a surrounding growth of sugar-cane, pigeon pea or a similar crop during the rainy season.

Experiments to determine the value of cyanamide as a remedy for white grubs [*Lachnosterna*] in cane soil show that heavy applications of this substance when used alone have no effect, even on second instar grubs. Mixtures of cyanamide with other chemical fertilisers are being tested. The trapping of the changa [*Scapteriscus vicinus*] with lights has been continued; up to the present 58 per cent. of the catch has consisted of females.

FROGGATT (W. W.). **A Serious Pest to Stored Wheat: The Lesser Grain Borer** (*Rhizopertha dominica*).—*Agric. Gaz. N.S.W., Sydney*, xxix, no. 10, October 1918, pp. 726–728, 2 figs. [Received 20th January 1919.]

Besides *Calandra oryzae*, which is the commonest grain pest in New South Wales, and *C. granaria*, which is rare, *Rhizopertha dominica* has also recently been observed in wheat stacked in grain sheds in certain localities. The damage caused by this beetle is similar to that observed in India and elsewhere [see this *Review*, Ser. A, v, p. 126]. Through the winter in New South Wales the beetles remain quiescent and do not attempt to feed upon the grain. In the stacks, during a warm sunny day even in midwinter they may be seen crawling about on the exposed surfaces of the bags in which they had been feeding in June. All empty bags, etc., used in infested sheds should be quarantined and thoroughly disinfected with hot air before being used again.

FLETCHER (T. B.). **Report of the Imperial Entomologist.**—*Scient. Repts. Agric. Research Inst., Pusa, 1917–18*; *Calcutta*, 1918, pp. 84–116, 20 plates. [Received 21st January 1919.]

Work on cotton bollworms continued throughout the year showed that at the beginning of the season, especially from July to the middle of October, *Earias fabia* and *E. insulana* are the predominant species; but later on, to the end of January during the cotton-picking season, *Pectinophora* (*Platyedra*) *gossypiella* is chiefly present and does considerable damage. *Microbracon* spp., which normally parasitise *Earias*, can also attack the lavae of *P. gossypiella* in the shoots and pods, but are unable to reach them when in the cotton seeds. The best trap-crop for bollworm larvae is *Hibiscus abelmoschus*. The practice of sowing cotton intermixed with another crop was found to be advantageous, but *Cajanus indicus* was not found to be suitable for this purpose. Other insects very injurious to cotton during the year were a weevil, *Pempheres affinis*, a scale, *Pseudococcus* sp., a Cercopid, *Machaerota planitiae*, and a mite, *Eriophyes* sp.

Lepidopterous stem-borers in rice studied during the year were:—*Schoenobius incertellus* (*bipunctifer*), the larvae of which were found dead and dry within the stubble, being too sluggish to move to safer quarters when the climatic conditions became unfavourable, and also being killed by exposure to the sun after ploughing the stubble in

spring; *Chilo simplex* and an unidentified species of the same genus, which also hibernate in the stubble; and *Sesamia inferens* which remains active throughout the year.

Borers attacking Graminaceous plants in addition to *Chilo simplex*, *Diatraea auricilia*, and *D. venosata*, recorded in the previous year, included a species of *Chilo* in *Saccharum arundinaceum* and *S. fuscum*, and ? *Anerastia ablutella* in sugar-cane. A key to the larval forms of these borers is given. Among insects, other than borers, found underground among the roots of sugar-cane were:—*Anomala bengalensis*, *A. biharensis*, *Adoretus caliginosus*, *Autoserica* sp., *Myllocerus discolor*, *M. blandus*, *Monolepta signata*, *Formicomus* sp., *Pachnephorus* sp., *Alissonotum piceum*, *A. simile*, *Apogonia* sp. and an unidentified Chrysomelid. Of these, *A. bengalensis* did a small amount of damage through the larvae entering the basal part of new shoots from the side, causing a dead heart, but the rest were of very minor importance as pests. Sugar-cane grown on a piece of waste land overgrown with *Saccharum spontaneum* and *Imperata arundinacea* brought *Gryllotalpa africana* prominently into notice as a pest of young sugar-cane, as much as 15 per cent. of the plants being damaged by it. The attempt to protect sugar-cane setts from termites by dipping them in a solution of 1 lb. lead arsenate in 2 gals. cold water met with no success, the liability of sugar-cane to damage by termites depending largely on the nature of the soil in which it is grown, being less in clayey soils than in sandy ones.

An investigation of the parasites of the indigo Psyllid (*Arytaina isitis*) was begun in April 1918, and so far three species of Chalcids have been obtained, one of these being very common.

It has been found that the "tukra" disease of mulberry, resulting in curling and malformation of the shoots and new leaves is due to the presence of an unidentified species of *Pseudococcus*. This mealy-bug becomes active at Pusa at the beginning of March and passes through a complete life-cycle in 24 days, the generations however overlapping. The mature nymphs, as well as the females, are parasitised by three species of Chalcids, one of which is particularly effective. The larva of a Cecidomyiid fly (? *Coccodiplosis* sp.) has been found to attack the eggs, the fly maggots being found chiefly in the ovisacs of the mealy-bug. The larva of a Coccinellid beetle also attacks the nymphs and females of this mealy-bug. The removal and burying or burning of affected mulberry shoots was not efficacious, as the nymphs hide in the crevices of the unexpanded leaf-buds. A thorough spraying with fish oil-resin soap subsequent to the removal of affected shoots might probably prove more effective.

A Lepidopterous fruit pest found on apple in north-west India and Assam has been identified as *Gracilaria zachrysa*, Meyr.

Among the numerous insects reared in the insectary the following new pests are recorded:—An unidentified Longicorn borer (? *Nupserha* sp.) found in stems of *Vigna catjang* in August, which bores in the main stem causing it to swell, the plants, though not killed, becoming stunted and bearing no fruit; a Pyralid, an undescribed species of *Tirathaba*, boring into young coconut fruits on the tree and causing them to drop off, similar damage being caused in Fiji by an allied species, *Tirathaba trichogramma*, Meyr.; *Diocalandra frumenti* (*Calandra stigmaticollis*), reported as killing large coconut trees by

boring into the stem, similar damage by this weevil having been recorded in Malabar, while in confinement it has also been reared on sugar-cane stems; an unidentified Longicorn, the larvae of which bore into young orange shoots in spring, causing them to wither; a small Eurytomine Chalcidid infesting *Sesbania* pods, which shrivel without setting seed if attacked when young, the pest being best controlled by picking off the dry pods at frequent intervals.

Other insects reared during the year included: *Amsacta moorei sara*, the life-cycle of this moth occupying a full year; the weevil, *Eugnamptus marginatus*, the larvae of which sometimes remain underground in a resting state for more than a year; *Agrotis ypsilon*, which is capable of breeding in the plains during the rains; *Azygophleps scalaris*, found for the first time boring in *Sesbania* stems, there being only one generation in the year, aestivation and hibernation taking place in the larval state; *Agromyza* sp., attacking pea plants to the extent of about 8 per cent.; *Cryptorrhynchus gravis*, a weevil seriously damaging mango fruits; a Longicorn borer (?*Oberea* sp.) in stems of *Phaseolus aconitifolius*, living for 2 years in the larval state; *Cosmopteryx phaeogastra*, Meyr., referred to in the previous report as *C. manipularis* and mining in bean leaves; *Argyroploce paragramma* boring into new bamboo shoots and causing the death of a large number of them; *Nodostoma subcostatum*, a Chrysomelid pest of plantain and young grape-vine leaves; *Balaninus c-album*, a weevil reared from seeds of *Eugenia jambolana*, practically every one of which harbours a larva, the only remedy being the thorough destruction of the seeds; a white mite which attacks the young leaves of jute, but which was effectively controlled by a spray composed of 1 lb. olene soap and 6 oz. flowers of sulphur in 12 gals. water; a Pyralid, *Glyphodes caesalis*, a jak pest in southern India, but not before noted as a pest north of the Madras Presidency; a Buprestid, *Belionota prasina*, apparently causing the death of a mango tree; a weevil, *Alcides frenatus*, and a moth, *Chlumetia transversa*, infesting mangos; *Giaura sceptica*, the caterpillars of which roll the young leaves of velvet bean; the Lepidoptera, *Catochrysops cnejus*, *Anarsia ephippias*, *Eucosma melanaula*, and *Eublemma hemirhoda*, all of which damage the flowers of *Phaseolus mungo*; *Argyroploce leucaspis*, the larvae of which roll and nibble the young leaves of litchi, which were also mined by the larvae of *Acrocercops hierocosma*.

The method of storing grain under sand continued to give good results, but straw granaries, when tested, were not so satisfactory as had been anticipated. *Tribolium castaneum* does great damage to wheat flour by imparting to it a characteristic nauseous taste and smell, especially during the rains, and in bad cases rendering it quite uneatable. Whole wheat in the grain, when undamaged by *Calandra* or *Rhizopertha*, is not affected by this beetle. For the first time in the Pusa area, *Bruchus chinensis* and another unidentified species were found to breed to a limited extent in cow-pea pods in the field. This beetle is essentially a pest of stored pulse, to which it causes serious damage. Another unidentified species of *Bruchus* was found breeding in *Sesbania* pods in the field, the emergence of adults lasting from February to June. Breeding did not occur in stored seeds. Damage to seeds of pea (*Pisum arvense*) by *Bruchus affinis* was reduced by drying them in the sun for 7 days.

Experiments with insecticides showed that resin compound, fish-oil resin soap and a proprietary contact insecticide "Incosopol" were all about equally effective against Aphids, Aleurodids, scale-insects and mealy-bugs. Experiments showed that *Periplaneta americana* (common cockroach) could be effectively, though very slowly, poisoned with boracic acid in honey, and could also be trapped by means of a kerosene tin containing a weak solution of molasses in water. Extended experiments on the protection of wood against *Microtermes obesus* have shown that the deterrent effect depends on the treatment employed, the variety of wood treated and the kind of termite against which protection is sought. At Pusa it has been found that teak, sissoo and jarrah naturally resist *M. obesus* without treatment. Wood can be rendered immune by impregnating it with arsenicals, or creosote (or wood-tar) or some similar liquid, immunity lasting until the poison is washed out or the odour disappears. In practice, treatment with arsenicals is not easy without a pressure apparatus to ensure penetration of the wood.

During 1917–18 it was found that besides the species of *Eublemma* and of Chalcids that normally attack lac (*Tachardia lacca*) whilst on the trees, considerable damage was done to brood-lac on *Zizyphus jujuba* by *Holococera* (*Hypatima*) *pulverea*. The larvae of this moth commonly damage scraped and unwashed stick-lac in store, but do not usually attack the growing lac.

ANSTEAD (R. D.). **Castor Oil Plant and Tea.**—*Planters' Chronicle, Bangalore,* xiii, no. 50, 14th December, 1918, p. 799.

A correspondence having arisen as to the reason why it is injurious to tea crops to grow castor oil plants in the vicinity, the author points out that most of the reasons given are incorrect, the fact that these plants attract Aphids and the caterpillars, *Achaea* (*Ophiusa*) *melicerta* and *Trabala vishnu,* being nearest the truth.

The real reason is that *Xyleborus fornicatus* (shot-hole borer), a serious pest of tea, is harboured by the castor oil plant to a greater degree than by any other, and therefore it should be removed entirely from tea-growing areas, as without this step total eradication of the pest is impossible.

BEESON (C. F. C.). **Forest Zoologist's Report on the Bee-hole Borer Investigations of 1918.**—*Rangoon,* 1918, 4 pp., 1 chart. [Received 22nd January, 1919.]

The Cossid, *Duomitus ceramicus,* Wlk. (bee-hole borer), has a normal life-cycle of one year, though a cycle of two years or at least two larval feeding seasons not infrequently occurs. Control by trapping the adult moths, inspecting the trees to locate early larval attack, or destroying or concentrating the young larvae by means of grease bands, deterrents, trap-trees, etc., is impossible, since eggs are laid anywhere from the ground to a height of 70 ft.

As the result of investigations carried out during 1918 in Burma, the following conclusions have been reached:—That in numerical incidence the borer has appreciably increased during the last 20 years in planted areas, this being probably directly referable to the increase in breeding facilities provided by plantations; the percentage

of attack varies locally very considerably from year to year; there is a tendency for attacked trees to occur in groups, but the position and composition of the groups varies from year to year; all the trees comprising the final crop of a teak plantation will be bee-holed, while the number of holes in the bole length will be sufficient to render it useless for timber; mixed forests rich in teak show an appreciably lower borer incidence than pure teak plantations in the same locality; plantations in which bamboos and trees other than teak have encroached or infiltrated, so as to form part of the canopy, show a lower incidence than plantations with a dense undergrowth of bamboos and shrubs but with complete canopy; the protective effect of undergrowth on individual trees is not measurable; in plantations without any undergrowth the borer appears earlier than in plantations with undergrowth, *i.e.*, as soon as there are trees of 12 inches girth; no natural conditions of undergrowth or second storey growth offer sufficient protection to the teak crop to cause a requisite reduction in the incidence; if the trees marked in thinnings are felled before the end of the year the borers in those trees will die; if thinnings are made in the canopy only, leaving dominated and suppressed trees standing, less than half the number of borers is removed; the shorter the intervals at which thinnings are made, and the earlier they are begun, the greater the effect on the incidence of the borer, since the percentage of borers removed in thinnings decreases with the age of the crop.

FERRIS (G. F.). **A Remarkable Case of Longevity in Insects (Hem., Hom.)**—*Entom. News, Philadelphia*, xxx, no. 1, January 1919, pp. 27-28.

The Coccid genus *Margarodes* contains certain species in which the first-stage larva possesses legs and antennae, these appendages being lost in the intermediate stages and reappearing in the adult. All of the described species are subterranean in habitat, and in all the intermediate stages are enclosed within a tough, hard cyst formed from the secretions of certain dermal glands.

One species, *M. vitium*, is a native of Chile and Venezuela, where it feeds upon the roots of grapes, being at times a pest of some importance. It has been recorded that adults have emerged from cysts that have been kept for 7 years upon their being immersed in water, no food having been taken in the meantime. This is apparently an adaption to the peculiar climate of its habitat, where rains occur but once in 7 years or longer. An instance is here recorded of a specimen received in 1899 or perhaps earlier, the date of collection being unknown, which, when histologically examined in 1917, gave every evidence of having been alive at the time of fixation, showing that the insect had existed for at least 17 years without food.

ENTOMOLOGICAL NOTICES.

Mr. G. F. Hill has been appointed Entomologist at the Australian Institute of Tropical Medicine, Townsville, North Queensland.

Felt (E. P.). **33rd Report of the State Entomologist on Injurious and other Insects of the State of New York, 1917.**—*New York State Mus. Bull., Albany, N.Y.*, no. 202, 1918, 240 pp., 12 plates, 82 figs. [Received 21st January 1919.]

This report deals at length with the more important insect pests of 1917, including such fruit-tree pests as *Cydia pomonella*, L., *Hemerophila pariana*, Clerck, *Macrosiphum solanifolii*, Ashm., *Porthetria dispar*, L., *Datana ministra*, Drury, *Schizura concinna*, S. & A., *Cydia* (*Laspeyresia*) *molesta*, Busck, *Rhagoletis pomonella*, Walsh, *Taeniothrips inconsequens*, Uzel (*pyri*, Dan.), *Heterocordylus malinus*, Reut., and *Lygidea mendax*, Reut. (red bugs), and *Byturus unicolor*, Say.

Grass and grain pests include June beetles and white grubs, *Lachnosterna* (*Phyllophaga*) *fusca*, Frohl., and other species, *Sphenophorus* sp. (corn bill-bug), *Sitodiplosis* (*Thecodiplosis*) *mosellana*, Gehin (wheat midge), *Crambus luteolellus*, Clem. (grass webworm), *Melanoplus atlantis*, Riley, and other grasshoppers, and *Pediculopsis graminum* Reut. (grass mite).

Numerous garden pests are recorded, including *Macrodactylus subspinous*, F. (rose chafer), *Otiorrhynchus sulcatus*, F. (black vine weevil), *Pegomyia fusciceps*, Zett. (seed-corn maggot), *Chlorochroa uhleri*, Stål (juniper plant bug), *Pseudococcus comstocki*, Kuw. (Japanese mealy bug), *Forficula auricularia*, L. (European earwig), and *Isotoma minuta*, Tullb. (European spring-tail).

This bulletin also contains an appendix of 130 pages which forms Part VI of the author's monograph on gall-midges.

Wilson (H. F.). **Three New Lachnids with Comparative Notes on Three Others (Homop.).**—*Entom. News, Philadelphia*, xxx, no. 1, January 1919, pp. 1–7, 2 plates.

The new Aphids described in this paper are *Essigella pini*, taken on *Pinus virginiana* in Maryland, *Eulachnus thunbergii*, collected on twigs of *Sciadopytis verticillata* and *Pinus thunbergii* at Tokyo, Japan, and *Lachnus juniperivora* on *Juniperinus virginiana* in Maryland.

A new genus *Unilachnus* is erected with *Lachnus parvus*, Wilson, as the geno-type. This Aphid occurs on the needles of *Pinus virginiana* and *P. rigida*, the type locality being the District of Columbia.

Becker (G. G.). **A One Year Life Cycle for** *Saperda candida*, **F., reared in an Apple. (Col.).**—*Entom. News, Philadelphia*, xxx, no. 1, January 1919, p. 24.

An attempt to rear two larvae of *Saperda candida* in the fruit of apple was made with larvae hatching from eggs deposited in apple during 1917. During their development they were fed on fruits in all stages ranging from young green fruits to old and rotten ones, and it was probably this factor which caused the death of one individual at the time of pupation and lengthened the life-cycle of the other beetle to a full year.

(C552) Wt. P2/137. 1.500. 4.19. B.&F.Ltd. Gp.11/3.

Weiss (H. B.) & Nicolay (A. S.). *Eumerus strigatus*, Fall., the Lunate Onion Fly, in New Jersey, (Dip.).—*Entom. News, Philadelphia*, xxx, no. 1, January 1919, p. 27.

The first definite record of the occurrence of the Syrphid, *Eumerus strigatus*, in New Jersey was made in February 1918, though its presence had been suspected several years ago in connection with iris roots injured by *Macronoctua onusta*, Grote. It has also been recorded from New York, and as having been bred from bulbs from Connecticut and Texas. In Holland, *E. strigatus* and *Merodon equestris* are the most important pests of narcissus.

The flies appear in May and June and oviposit on the bases of the leaves. The larvae enter the nose of the bulb, from 10–30 being found in a single one, and feed in the interior, causing it to decay; the destruction is more complete and rapid than that caused by *Merodon equestris*. Pupation takes place in the outside leaves during August, and a second brood, of which little is known, appears in September and October. In Holland, the destruction of infested bulbs appears to be the usual remedial method.

McCall (J. S. J.). **Report of the Director of Agriculture.**—*Nyasaland Protectorate Ann. Rept. Dept. Agric. for Year ended 31st March 1918, Zomba*, 31st October 1918, pp. 3–8. [Received 24th January 1919.]

A serious infestation of the tobacco beetle [*Lasioderma serricorne*] occurred in 1917 in tobacco awaiting shipment at Chinde during July and August, this having probably arisen from some infested tobacco from the previous year. It was decided after inspection to erect a fumigation house and treat the tobacco before shipping. The results were so satisfactory that it has been arranged that all future consignments of tobacco from Nyasaland shall be similarly treated, and special legislation to give effect to this is under consideration. It is reported that no damage to the tobacco results from the treatment. The most satisfactory mixture for fumigation is 64 oz. sodium cyanide, 80 oz. sulphuric acid and 128 oz. water per 1,000 cubic feet. The fumigation house is closed for 70 hours, is opened on the evening of the third day and remains open overnight to allow the fumes to escape. It is then emptied and refilled in the morning of the fourth day, thus allowing two fumigations a week.

Brain (C. K.). **The Coccidae of South Africa–II.**—*Bull. Entom. Research, London*, ix, no. 2, September 1918, pp. 107–139.

Gall-making Coccids are little known in South Africa, and three new ones are here described:—*Grewiacoccus gregalis*, gen. et sp. n., on *Grewia occidentalis*, *Calycicoccus merwei*, gen. et sp. n., on *Apodytes dimidiata*, and *Amorphococcus acaciae*, sp. n., on *Acacia*.

An account is also given of representatives of the sub-families Conchaspinae and Diaspinae with a synoptical key to the South African genera and another to the South African species of *Aspidiotus* s. str.

The following new species are described: *Conchaspis euphorbiae* on *Euphorbia*; *Aspidiotus furcillae* on *Acacia horrida*; *A. regius* on

aloe; *A. kellyi* on *Andropogon amplectens*; *A.* (*Diaspidiotus*) *ehretiae* on *Ehretia hottentottica*; *A.* (*Selenaspidus*) *pumilus* on New Zealand flax (*Phormium tenax*); *A.* (*S.*) *griqua* on *Arthrosolen polycephalus*; *A.* (*S.*) *pertusus* on *Euphorbia* and *Mimusops*; and *Furcaspis proteae* on *Protea* and *Faurea saligna*.

LAMB (C. G.). **On a Parasitic *Drosophila* from Trinidad.**—*Bull. Entom. Research, London*, ix, no. 2, September 1918, pp. 157–162, 4 figs.

Drosophila paradoxa, sp. n., is here described from material collected in Trinidad by Mr. C. B. Williams and stated by the collector to be parasitic on a Cercopid of the genus *Clastoptera* which was found attacking casuarina trees.

In a later communication the collector reported that a *Drosophila* he found in Panama was not a true parasite of *Clastoptera* but only an inquiline. In Trinidad, however, he collected about 30 spittle-masses of an allied species of *Clastoptera* on *Casuarina* trees, about half containing *Drosophila* larvae with their heads buried in the *Clastoptera* nymphs between the dorsal and abdominal plates. Similar habits have been observed in *Drosophila inversa*, Wlk., in Minnesota, and this species, incorrectly determined as *D. sigmoides*, Lw., has also been reported as having been bred from pupae found in the froth of a Cercopid.

WILLIAMS (C. B.). **A Froghopper on Sugar-cane in British Guiana.**—*Bull. Entom. Research, London*, ix, no. 2, September 1918, pp. 163–173, 3 figs.

The froghopper found attacking sugar-cane in British Guiana is *Tomaspis flavilatera*, Urich, which in 1915 and 1916 was generally distributed along the east coast and in small numbers on a plantation just west of the Essequibo River, though no serious damage has, as yet, been done by it. During the daytime the adults may be found in large numbers on the short succulent grass growing along the drainage trenches which intersect the sugar plantations and separate the high dry ridges on which the cane grows. The absence of any long dry season, together with the low level of the land, ensures the fields being always more or less damp.

Control may be exercised in various ways, such as flooding the fields, a method quite impossible in Trinidad; by hand labour while the fields are flooded, the nymphs which crawl up the stems being shaken off into the water and destroyed; by sweeping the ditches with a hand net, a very efficacious method, but one which is impracticable in Trinidad owing to slight differences in the habits of the insect and in methods of cultivation; by the use of trap-lights, the results of which are, however, negligible.

Natural enemies include a Chalcid egg-parasite, *Oligosita giraulti* (vermilion parasite), and a species of *Haplothrips*, a thrips that also destroys the egg; the Syrphid fly, *Salpingogaster nigra*, attacking the nymph; the Reduviids, *Heza peramata*, Kirby, and *Zelus mimus*, Stål; the predaceous grasshoppers, *Pflugis mantispa*, Bol., and *Xiphidium propinquum*, Redt.; dragonflies; Attid spiders; predatory ants feeding on the adults but not on the nymphs, which are protected

by their covering of froth ; *Metarrhizium anisopliae* (green muscardine fungus) ; lizards, which are more abundant than in Trinidad, probably owing to the scarcity of the mongoose ; and birds, which should be encouraged by the planting of bushy trees in the cane-fields.

SANBORN (C. E.). **Report of the Entomological Department.**—*27th Ann. Rept. for Year ending June 30, 1918, Oklahoma Agric. Expt. Sta., Stillwater*, 15th November, 1918, pp. 35–40.

The false chinchbug [*Nysius ericae*, Uhl.] does not generally subsist on cereals as the true chinchbug [*Blissus leucopterus*] does, but on many of the succulent weeds and on garden vegetables such as turnip. Under certain conditions it may be controlled by the use of the blow-torch, the insects not being able to withstand as much heat as the plants on which they usually subsist.

The sexual stage of *Aphis medicaginis* (cow-pea aphis) occurs on the common black locust tree (*Robinia pseudacacia*), the asexual form feeding mainly on leguminous plants to the number of at least 20 different species. Oviposition occurs in November solely on the locust tree in Oklahoma ; the presence of this tree therefore hinders control measures, the chief of which is spraying with nicotine sulphate at the rate of 1 pint in 100 gals. water per acre.

COOLEY (R. A.). **15th Annual Report of the State Entomologist of Montana.**—*Univ. Montana Agric. Expt. Sta., Bozeman*, Bull. no. 124, February 1918, pp. 195–208. [Received 30th January 1919.]

The occurrence of the more common insect pests of 1917 is recorded in this report and the connection between economic entomology and the War is discussed.

In connection with the grasshopper outbreak of 1917, it was found that eggs were present in abundance in the middle of April, as well as some dead grasshoppers of the previous year, with evidence of the damage done by them to winter wheat. Eggs were mainly found around lucerne and clover fields, many larvae and adults of a species of *Harpalus* (ground beetle) being found with them. The first eggs hatched about 15th May. The outbreak occurred in scattered localities throughout the State, in some spots being so severe that everything green was eaten off, and much greater damage would have resulted had not co-operative control work been undertaken. The grasshopper remains found in April were those of *Melanoplus atlantis*, Riley, or a closely related species, but those emerging in July more closely resembled the Rocky Mountain migratory locust [*M. spretus*].

The presence of many flesh-flies (*Sarcophaga*) which parasitised the adult grasshoppers was probably the factor controlling this outbreak. No eggs were found during a search in autumn, and it is therefore hoped that there will be no serious injury in the next season.

COOLEY (R. A.). **The Entomology Department.**—*24th Ann. Rept. for Year ending June 30, 1917, Univ. Montana Agric. Expt. Sta., Bozeman*, February 1918, pp. 242–248, 1 map. [Received 30th January 1919.]

Estimates of insect damage are always given in terms of losses caused by insects, while the saving effected by control has been

neglected. Such an example of saving or increased production is seen in the case of *Pemphigus betae*, Doane, the experimental control of which by irrigation was begun in 1914, resulting in an increase in tonnage and sugar content; this was probably due in part to increased irrigation as well as to the destruction of insects.

The chief entomological feature of 1917 was an outbreak of grasshoppers, the species of which is not yet definitely established, though there is much reason to think that it is the injurious Rocky Mountain locust [*Melanoplus spretus*] so destructive some 50 years ago [see above]. Preventive work took the form of distributing poisoned bran mash, in the making of which 10,000 lb. of white arsenic were used, and of using grasshopper catching machines. By the latter means vast numbers were caught, which in the dried state formed a valuable poultry food.

SWINGLE (D. B.) & MORRIS (H. E.). **Plum Pocket and Leaf Gall on Americana Plums.**—*Univ. Montana Agric. Expt. Sta., Bozeman,* Bull. no. 123, February 1918, pp. 167–188, 6 figs. [Received 30th January 1919.]

The growing of Americana plums in Montana has been greatly hampered and finally brought to a standstill by a fungous disease and by the leaf-gall mite, *Eriophyes pruni*, Schoene, which hibernates under the bud-scales. Upon the opening of the buds these mites emerge and puncture the young leaves forming pimples that soon develop into galls. These do not kill the leaves outright, but if numerous, they seriously interfere with their normal functions.

This mite is easily controlled by spraying with dilute lime-sulphur (28° Bé., diluted 1 in 50) while the trees are still dormant, and in some seasons when the buds are in the pink; after the petals fall, it is too late to get the best results. If rain follows within two days after spraying, the operation should be repeated.

SPEIGHT (R.). **New Zealand Timbers and the Borer. A Note on the Susceptibility of New Zealand Timbers to the Attacks of the Borer,** *Anobium domesticum.*—*N.Z. Jl. Science and Technology, Wellington,* i, no. 3, May 1918, pp. 142–144. [Received 31st January 1919.]

This paper constitutes a record of the resistance of various New Zealand timbers to the attacks of *Anobium domesticum*, L. A list is given from which it is seen that some are immune, while many others are attacked in the sap-wood, the heart-wood being untouched. In view of the threatened shortage of timber, attempts should be made to preserve it, as for instance by soaking it in petrol in which carbolic acid and camphor have been dissolved. As carbolic acid is somewhat soluble in water, the efficacy of the solution can be increased by substituting naphthaline for it.

LEONARDI (G.). **Terza Contribuzione alla Conoscenza delle Cocciniglie italiane.** [A Third Contribution to the Knowledge of Italian Coccidae.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici,* xii, 1917–1918, pp. 188–216, 13 figs. [Received 6th January 1919.]

As the Coccid fauna of Italy has been increased by various additions in the past few years they are briefly recorded in this paper, to which a list of the species now known in Italy has been added.

The following species are described as new :—*Aspidiotus ligusticus*, on grape-vine ; *Eulecanium piligerum* on plum ; *Pseudococcus diminutus* on *Phormium tenax* [New Zealand flax] ; *P. notabilis* on *Myoporum tuberculatum* and *Nicotiana* sp. ; *Ripersia silvestrii* taken from a nest of the ant, *Plagiolepis pygmaea*, Latr. ; and *Eriococcus cactearum* on *Cereus*, *Mamillaria*, *Echinopsis*, etc.

SARRA (R.). **Intorno ad un Imenottero Tentredinide (*Cimbex 4-maculata*, Müll.) dannoso al Mandorlo.** [A Tenthredinid, *Cimbex 4-maculata*, injurious to the Almond.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, 1917–1918, pp. 275–286. [Received 6th January 1919.]

Two sawflies, *Eriocampoides limacina* (*Caliroa cerasi*, L.) and *Cimbex quadrimaculata*, Müll., are injurious to the almond. The former occasionally attacks almond trees when near cherry trees infested by it, but does no serious harm, while the latter is exclusively a pest of the almond. The various stages of *Cimbex quadrimaculata* are briefly described. It is found in central and south Europe and in Asia Minor. In the Italian provinces of Potenza and Bari the adult appears at the end of March and early in April, emerging from the preceding year's cocoon. Mating occurs during the first fortnight in April and oviposition takes place in mid-April. The eggs are deposited in cuts made by the ovipositor on the upper surface of the leaf. The slit within which the egg has been laid closes up, and the larva hatches after an incubation period of 20–22 days and feeds on the leaves. There are four moults. During the period between mid-June to early July the larva builds its cocoon. The prepupal stage is passed within the cocoon and the pupal stage, lasting about a month, begins about the end of February of the following year.

The most serious injury occurs in the case of young seedlings or young graftings. Birds do not appear to prey upon the larvae of *C. quadrimaculata*, which is however checked by two Ichneumonids, *Opheltes glaucopterus*, L., and *Lampronota melancholica*, Grav. The former parasitises about 20 per cent. of this sawfly and the latter about 25 per cent. Both of these parasites have one annual generation.

The remedial measures advised are the collection of the larvae infesting graftings and seedlings, or better, by a poison spray applied in May. In the case of older plants these methods are too costly and natural enemies must be relied on.

SILVESTRI (F.). **Contribuzione alla Conoscenza dei Termitidi e Termitofili dell' Africa occidentale. II. Termitofili.** [A Contribution to the Knowledge of the Termites and Termitophiles of Western Africa. II. Termitophiles.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, 1917–1918, pp. 287–346, 47 figs. [Received 6th January 1919.]

A list is here given of the Protozoa, Nematodes, Crustacea, Arachnida and insects associated with the following termites :—*Cryptotermes havilandi*, Sjöst., *Glyptotermes parvulus*, Sjöst., *Schedorhinotermes putorius*, Sjöst., *Coptotermes sjöstedti*, Holmgr., *Termes bellicosus*, Smeath., *Hamitermes runcornifer*, Silv., *Cubitermes oculatus*, Silv., and *Microcerotermes fuscotibialis* subsp. *libericus*, Rosen.

SILVESTRI (F.). **Un Genere e due nuove Specie di Calotermitidi (Insecta Isoptera) dell' Eritrea (Africa or.).** [A new Genus and two new Species of Termites from Eritrea, Eastern Africa.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, 1917–1918, pp. 347-351, 2 figs. [Received 6th January 1919.]

A description is here given of *Epicalotermes aethiopicus*, gen. et sp. n., taken from a dried branch of *Acacia* sp., and of *Neotermes erythraeus* taken from the dead wood of unknown plants.

HAVILAND (M. D.). **Notes on Some Aphids collected in South-Eastern Russia in 1917.**—*Entomologists' Mthly. Mag., London*, liv, no. 652, September 1918, pp. 200–202.

The Aphids here recorded include *Macrosiphum sonchi*, L., taken on *Cichorium* in August and *Centaurea* in October; *Myzus cerasi*, F., not uncommon on wild cherry in July; *Rhopalosiphum ribis*, L., causing twisting and distortion of currant shoots; *Aphis cardui*, L., taken on thistle in June; *A. laburni*, Kalt., very abundant at the end of June, twisting and stunting young shoots of acacia, and also occurring on lucerne; *Cryptosiphum artemisiae*, Buckt., taken under the leaves of *Artemisia* in July; *Dryobius croaticus*, Koch, found in July on oak shoots; *Eriosoma* (*Schizoneura*) *ulmi*, L., common on elm in June; and *Tetraneura ulmi*, De G., the empty flask-shaped galls of which were found on elms in July.

LYLE (G. T.). **An Entomogenous Fungus growing from the Cocoon of a Braconid.**—*Entomologist, London*, li, no. 665, October 1918, pp. 227–229, 1 fig.

In the autumn of 1915 the cocoons of an Aphid-destroying Braconid, probably *Praon volucre*, Hal., were found in the New Forest to be attacked by a fungus, *Isaria arachnophila*, hitherto supposed always to infest spiders. This seems to be the first time that an entomogenous fungus has been recorded as attacking a Braconid, though *Cordyceps myrmecophila* has been found on an Ichneumonid.

SCOTT (H.). **Swarming of the Chalcidid, *Pteromalus deplanatus*, Nees, in Buildings.**—*Entomologists' Mthly. Mag., London*, lv, no. 656, January 1919, pp. 13–16.

Vast swarms of the Chalcid, *Pteromalus deplanatus*, Nees, invading houses, have been recorded for three years in succession near Godalming. The invasion begins about the middle of July and lasts, if the weather is seasonable, till about the end of August.

An explanation of these swarms that has been suggested is that they originate in the buildings where they occur from Anobiid beetles in the woodwork. To this it may be objected that they have been definitely recorded as entering buildings from without and that incredible numbers of Anobiids would have to be present to explain the existence of such myriads of parasites, even if many emerged from a single host. Another, and more probable explanation is the recent extreme abundance of *Tortrix viridana* of which *P. deplanatus* is a parasite.

GATENBY (J. B.). **Note on *Apanteles glomeratus*, a Braconid Parasite of the Larva of *Pieris brassicae*.**—*Entomologists' Mthly. Mag., London*, lv, nos. 656 & 657, January & February 1919, pp. 19-26.

The Braconid, *Apanteles glomeratus*, generally attacks young caterpillars of *Pieris brassicae*, in which it deposits from 30 to 60 eggs, all of which hatch out. The resulting larvae eat the fat-body of the host and finally emerge when the latter is about full-grown. They issue simultaneously from the middle third of the body of the host and immediately begin to spin cocoons. Parasitised Pierid larvae appear to be able to grow to the same size as normal individuals, but the gonads are nearly always seriously reduced and no spermatozoa are developed. When only a few parasites have been present, the host larva may arrive at the pupal stage, and it has even been recorded that such an individual has given rise to an imago.

GOODWIN (W. H.). **Grain Bin Sanitation. Insect Injuries to Stored Cereals prevented by Cleaning Bins.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 19, July 1917, pp. 223-224, 1 fig. [Received 1st February 1919.]

It is estimated that in Ohio the annual damage to stored grain by insects amounts to approximately £200,000.

Farmers can prevent injury to a large extent by cleaning the bins carefully each season before new grain is placed in them. After cleaning, the bins should be sprayed thoroughly with 10 per cent. kerosene emulsion and then allowed to dry for a week before use. Grain containing much moisture or showing signs of sprouting should be thoroughly dried before storage. Stored grain should be disturbed at least once a month by shifting it into another bin, and if air be pumped through the stored grain for several days in succession, beetles will leave the grain in large numbers. The latest investigations show that the best method of fumigation at 70° F. is to spray carbon bisulphide over the grain through a small opening in the side of the bin with a small spray pump. The opening should be immediately closed after spraying.

HOUSER (J. S.). **Insect Pests of Vegetables. Methods of Control suggested for the more troublesome Kinds.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 19, July 1917, pp. 232-240, 10 figs. [Received 1st February 1919.]

A brief description of the more common and destructive garden pests is here given, with an account of the damage they cause and notes on spraying materials and machinery, repellent mixtures and poisoned baits.

HOUSER (J. S.). **The Pink and Green Potato Plant Louse.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 20, August 1917, pp. 261-267, 6 figs. [Received 1st February 1919.]

The outbreak of *Macrosiphum solanifolii* (pink and green potato aphis) that occurred in Ohio in 1917 is dealt with in this paper, but has already been described from another source [see this *Review*, Ser. A, vi, p. 455].

GOSSARD (H. A). **Important Clover Insects. Damage, Description, Life-History and Control.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 28, April 1918, pp. 104–106, and no. 30, June 1918, pp. 190–193, 3 figs. [Received 1st February 1919.]

Hypera punctata (clover-leaf weevil) damages the leaves of red clover every spring, attacking other species to a less extent, as well as lucerne and beans. Eggs are laid during September and October, and while some hatch in about a month, others remain dormant until the clover leaves unfold in late March or early April. The larvae continue to feed until May or June, when they spin their cocoons in the ground or in rubbish among the plants, remaining in the pupal state for 2 to 3 weeks. Emergence continues from early May until mid-July. Both larvae and adults shelter during the day and feed at night, and drop quickly to the ground if disturbed. Natural enemies of *H. punctata* include certain predaceous beetles and their larvae, wild birds and domestic fowls, but none of these are efficient. The fungus, *Empusa sphaerosperma*, attacks and destroys the majority of the larvae in the spring, and without this natural check the weevil would be the most serious pest of clover. If this disease fails to control the insects in the spring, spraying might be practised in the autumn with arsenicals such as are used on potatoes.

Bruchophagus funebris (clover-seed Chalcid) appears in the adult form on warm days in spring just as the earliest clover heads are turning from green to brown, and eggs are laid in these florets and occasionally in newly opened bloom. Oviposition continues during May and June, adults from these eggs appearing in July and August. These lay their eggs in second-growth clover, and a small proportion of these eggs develop into adults in September and October, but most of the insects hibernate as larvae inside seeds lying on the ground. These develop in the granary, eating out the whole contents of the seeds. There is much overlapping of the broods and some individuals of each generation hibernate in the seeds, while adults can be seen from mid-May until mid-October. Cutting the clover in early June or pasturing until that date prevents oviposition by the first adults and disposes of eggs laid previously. Self-sown clover in the vicinity should be clipped during the cutting period. Screenings of clover or lucerne seed at threshing sites should be destroyed. Ploughing second-year clover under to a depth of 8 inches will bury most of the insects hibernating in seeds on the ground. All clover and lucerne seed should be well cleared with a fanning mill before being sown.

Cydia (Enarmonia) interstinctana (clover-seed caterpillar) attacks the seed crop of red, white, alsike and mammoth clovers. There are three generations of this moth in a year. The larvae of the winter generation hibernate in the field, feeding in the crowns of clover plants, while some pupate in late autumn. The first brood of adults begins to appear in mid-May and the moths are abundant by 1st June. All disappear in late June. Moths of the second generation are seen from late June throughout July, the larvae of this brood feeding during late July and early August. Moths of the third generation appear soon after the middle of August and disappear towards the end of September. Several Hymenopterous parasites infest the larvae and keep them in check. Remedial measures are the same as those for *B. funebris*. Clover should not be kept on the same ground for more

than two years. New clover should not be sown in the vicinity of old fields, and should be pastured or mown in the autumn of the first year.

GOSSARD (H. A.). **The False Apple Red-Bug.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 29, May 1918, pp. 153–155, 3 figs. [Received 1st February 1919.]

Lygidea mendax (false apple red-bug) has recently become increasingly numerous each year in the orchards of the Experiment Station at Wooster. There is one generation in a year. Adults appear during late June and early July, most of the eggs, which are laid in two-year-old wood just beneath the bark, being deposited in mid-July. These hatch in the following spring, generally in early May, and the nymphs attack the young blossoms. They cause the leaves to curl and the tissues to wither; the punctures are also frequently followed by attacks of fire-blight. The adults and older nymphs imbibe the sap from young branches and as soon as the young fruit is available they puncture it, causing a woody fibrous growth along the channel of the puncture. Infested fruits either wither and fall or become badly deformed. The most successful treatment as yet discovered is spraying the nymphs with 40 per cent. nicotine sulphate at the rate of one pint to each $87\frac{1}{2}$ gals. of the spray that is applied immediately after the falling of the blossoms. This can be used in combination with the lime-sulphur-arsenical mixture given for codling moth (*Cydia pomonella*) and will also be useful against Aphids.

STEAR (J. R.). **Clover Root Borer.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 30, June 1918, pp. 187–189, 2 figs. [Received 1st February 1919.]

Hylastinus obscurus (clover-root borer) is a comparatively new pest in Ohio, where, besides various clovers, lucerne and garden peas are also injured. Hibernation usually occurs in the adult stage, though a few larvae may be found in clover roots during the winter. The adult beetles emerge from the roots in early May and fly to other plants in the same or neighbouring fields. Oviposition occurs during late May and June. Eggs are deposited in cavities in the roots eaten out by the female beetles. About six eggs are placed in each cavity and these hatch in a few days, the young larvae burrowing into the root and frequently tunnelling the entire length. Sometimes the clover dies out in patches over the field and the roots are often entirely destroyed, this being especially noticeable in dry weather. Very little seed is produced. By the end of July most of the larvae have pupated in their burrows, and by October the majority of the adults have emerged, but remain in the roots throughout the winter. Clover in its first year is not attacked by the beetles, the roots being too small to attract them. Infested clover should be ploughed under as soon as possible after removal of the hay crop. This exposes the roots to sun and wind while the borers are still in the larval stage. If ploughing is delayed beyond 1st July, the larvae will have pupated and are then unaffected by ploughing. If this practice be followed for a few years, the pest will probably require no attention for several years. This is the only practical remedial measure, natural enemies being negligible.

GUYTON (T. L.). **Stalk Borers. Farm Practices that aid in destroying the Pests.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 32, August 1918, pp. 244–246. [Received 1st February 1919.]

The Lepidopterous borers dealt with in this paper include the Noctuid, *Papaipema nebris* (*nitela*), which has one generation a year. The eggs are deposited in masses of from 50 to 60, near the ground on grass and weeds. These hatch during May, the larvae first mining the leaves and then migrating to the stalk and tunnelling it out, resulting in withering and death of the top. When mature the larva cuts a hole through the side of the stalk and then pupates in the lower part of its tunnel. Pupation occurs in July, the moths emerging late in August. The adults fly at night from August to October, and oviposition occurs at this time. The early spring food-plants of the larvae are grasses and weeds, but later cultivated crops such as maize and wheat and in fact almost any plant may be attacked. The moth occurs throughout the United States and Canada east of the Rocky Mountains. When badly infested grassland adjoins a cultivated field the grass should be cut down before the larvae migrate to the cultivated crop. Weeds should be destroyed wherever possible, and in small plots any infested plants should be collected and destroyed. The caterpillars of species of *Hadena* are similar in appearance and method of boring and are controlled in the same way.

Melittia satyriniformis (squash borer) oviposits on the stems of squashes, pumpkins and melons in the early growing season, and the caterpillars live through the winter. Ploughing and cultivation in the autumn will kill many of the hibernating larvae. Plants should be collected and burnt as soon as the crop is mature. Infested stalks may be slit and, after removal of the larvae, wrapped round with waxed yarn, or the larvae can be killed by injections of carbon bisulphide. By covering the joints of the vine at intervals with soil, root systems will be developed to nourish the plant in case of injury at any point.

Elasmopalpus lignosellus (lesser corn-stalk borer) occurs in the southern part of Ohio. The larvae are active throughout the growing season, causing much loss to cultivated crops. The moth has four generations in a year and has a wide range of food-plants, apparently preferring grasses. Hibernation probably occurs in the larval and pupal stages. Infested fields should be ploughed in late autumn after all remnants of the preceding crop have been burnt. Harrowing of the field breaks up the winter quarters of the larvae and destroys many of them.

Diatraea saccharalis (larger corn-stalk borer) is occasionally found in the southern part of Ohio. The larvae attack the budding centre of young maize plants and later in the season descend the stalk and burrow in the pith, hibernating in maize stubble below the ground surface. Rotation of crops is one of the best preventive measures. Ploughing and cultivation in autumn break up the winter quarters of the larvae and expose them to the attacks of natural enemies.

STEAR (J. R.). **Flea-Beetles as Pests of the Garden.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 32, August 1918, pp. 251–253. [Received 1st February 1919.]

The flea-beetles here dealt with include:—*Systena blanda*, which attacks many crops, particularly maize and tomatoes; *S. taeniata*, attacking a variety of crops; *Epitrix cucumeris*, feeding upon potatoes,

tomatoes and cucumbers; *E. fuscula*, on egg-plant, potatoes and tomatoes; *Phyllotreta vittata*, on cabbage, turnips and similar crops; *Epitrix parvula*, on tobacco, potato; tomato and egg-plant; *Disonycha xanthomelaena* and *D. triangularis* on beets and spinach; *Chaetocnema confinis* on sweet potato; *Psylliodes punctulata* on hops, sugar-beet and a few other plants; *Haltica chalybea* on apple and pear foliage; *H. ignita* on strawberry and other plants; and *Chaetocnema pulicaria* and *C. denticulata* on maize.

The life-histories of these species are very similar. Adults emerge during the spring and oviposit generally on the roots, but occasionally on the leaves of some weed resembling the preferred cultivated food-plant. These larvae feed upon the weed roots until mature; they then pupate and the beetles emerge from the ground. In some cases the life-cycle requires only a month, but in others development is so slow that only one generation appears annually. Since with one or two exceptions the larval stage is passed on the roots of weeds, clean cultivation and the destruction of weeds should prevent these beetles from becoming very injurious. When the adults are numerous they should be sprayed with Bordeaux mixture to which 3 lb. lead arsenate powder (or 6 lb. paste) has been added for each 50 U.S. gallons of spray. Young plants may be protected at the time they are set out or transplanted by dipping the tops in 1 lb. lead arsenate to 8 to 10 U.S. gals. water. Tobacco, dust, lime, etc., may be dusted on the plants as a protection from attack; this should be done while dew is on the plants and should be applied often enough to keep them well covered with dust.

PARKS (T. H.). **Fall Practices to Destroy Cereal Crop Insects.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, no. 35, November 1918, pp. 333–336. [Received 1st February 1919.]

The general measures recommended for the destruction of pests of cereals are reviewed. The burning of fence-rows of blue-grass around fields infested with the chinch bug [*Blissus leucopterus*] during the autumn may be expected to destroy as many as 80 to 90 per cent. of the hibernating insects. The use of dust or tar barriers is also suggested against this pest, and where it has been abundant it is advisable to plant a strip of land adjoining the wheat field with oats or potatoes, as these crops are not susceptible to attack. Land to be planted with maize should have the sod ploughed in autumn or early winter; this will destroy such underground insects as cutworms, white grubs, wireworms, webworms and bill-bugs. All grass and weeds should be kept down before the maize is planted. As white grubs and wireworms require more than one year for development, land worked under a proper rotation of crops rarely becomes infested by them. They do not attack leguminous plants and therefore a crop such as red clover grown one year in every 3 or 4 will generally protect cereal crops from attack. Autumn cultivation of lucerne stubble will destroy many grasshoppers as well as webworms.

BENTLEY (G. M.). **The Cotton Boll Weevil in Tennessee.**—*Tennessee State Bd. Entom., Knoxville*, Bull. no. 22, September 1917, 14 pp., 24 figs. [Received 1st February 1919.]

This bulletin deals with the present status of the boll weevil situation in Tennessee for the purpose of familiarising cotton growers

with the habits of *Anthonomus grandis* and methods of dealing with it. Of these, the most effective consists in the starvation of late broods by doing away with the cotton which develops from late maturing bolls, and by selecting strains of early maturing cotton, the growth of which may be further advanced by intensively cultivating a smaller acreage. Dusting with lead arsenate is also proving efficacious, the poison being taken up in drinking the rain or dew adhering to the plant.

Weevil infestation in Tennessee is only slight as yet, but the annual loss is certain to be heavy, as it is in Texas and Alabama, unless rigid methods of control are adopted and generally practised.

PEMBERTON (C. E.) & WILLARD (H. F.). **A Contribution to the Biology of Fruit-fly Parasites in Hawaii.**—*Jl. Agric. Research, Washington, D.C.*, xv, no. 8, 25th November 1918, pp. 419–465, 41 figs., 1 plate.

This paper summarises the results of a general investigation of the biology, interrelation and economic value of introduced parasites of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly). The anatomy of *Diachasma tryoni*, Cam., *D. fullawayi*, Silv., *Opius humilis*, Silv., and *Tetrastichus giffardianus*, Silv., all of which are strictly larval parasites, is described at length.

Investigations on the parasitism of the melon-fly, *Dacus (Bactrocera) cucurbitae*, Coq., by the parasites of *C. capitata* have shown that no fruit-fly parasites will develop in melon-fly larvae under any conditions, except in the case of *Tetrastichus giffardianus*, and this species will do so only when in the presence of an egg or larva of the natural melon-fly parasite, *Opius fletcheri*, which itself develops normally in larvae of *C. capitata*.

In addition to the larval parasites introduced into Hawaii to control *C. capitata*, a Proctotrupid, *Galesus silvestrii*, Kieffer, was imported in 1913. This is a pupal parasite which, though breeding readily in confinement, has never been established in the open. It seems to act far more as a secondary than as a primary parasite, the female always ovipositing in larvae of *Tetrastichus giffardianus* as they lie developing in the fruit-fly puparium when they are not more than 4 days old.

A Pteromalid, *Pachycrepoideus dubius*, Ashm., introduced from the Philippines in 1914 as a dung-fly parasite, has been reared occasionally from fruit-fly puparia, though it is not an important fruit-fly parasite. The female oviposits in the puparium and the larva develops on the pupa as an external feeder. This insect may be a primary, a secondary, or a tertiary parasite; as a primary one it develops on the fruit-fly pupa, as a secondary on larvae or pupae of *T. giffardianus*, *O. humilis*, *D. tryoni*, *D. fullawayi*, or *G. silvestrii* as they occur as parasites in the fruit-fly puparium, and as a tertiary parasite it will develop on a larva of *G. silvestrii*, which in turn has been feeding in the larvae of the above-mentioned Opiines or *T. giffardianus*. It should be borne in mind that *G. silvestrii* is not known to be established in Hawaii as yet, and that *P. dubius* probably only parasitises a fraction of 1 per cent. of the fruit-fly puparia in the field, but that inter-relations between these and the other fruit-fly parasites may be expected as a natural sequence if they ultimately adapt themselves to Hawaiian conditions and become thoroughly established.

The cosmopolitan ant, *Pheidole megacephala*, F., is enormously abundant throughout the Hawaiian Islands at low elevations and it is quite probable that it checks and greatly limits the increase of several species of fruit-flies. It is quickly attracted to any fresh or decaying animal matter, and probably prevents the development of one-third to four-fifths of the larvae present in all fruits in the field.

Brooks (F. E.). **The Grape Curculio.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no 730, 24th December 1918, pp. 1–19, 2 plates.

Coeliodes inaequalis, Say (grape curculio) is the most destructive insect attacking the grape in many parts of the eastern United States. This weevil is markedly local in its occurrence and appears annually in destructive numbers in some localities, while remaining practically unknown in neighbouring districts. It was first recorded as a pest of grapes in 1853 in Ohio and has been reported from the New England States to Minnesota, and south to Missouri and Florida. There are no records of either the larvae or adults attacking the leaves or fruit of plants other than the grape under natural conditions.

The adults appear upon grape foliage in the spring and feed for 10 to 14 days on the upper epidermis and parenchyma of the leaf before beginning to oviposit within the young fruit. The eggs are deposited singly in a cavity which the female excavates in the pulp through a small hole made in the skin; as many as 16 may be deposited in a single day, and they hatch in about 6 days, the period of greatest egg-production being from the middle of July to the middle of August. The young larvae begin to feed before they are free from the egg-shell and within a few minutes have burrowed out of sight within the pulp, attacking the seed on the second or third day. The larvae remain in the grapes for from 7–19 days, the average time being 10–12 days. They emerge through small holes which they make in the skin, leaving the grapes during the morning hours, especially between the hours of 7 and 9, and pupate in cocoons constructed on the surface of the ground. The average length of the pupal period is 18 days, but those that leave the grapes late in August and in September pupate and remain within the cocoon until the following spring, issuing as adults at about the time the hibernating weevils are emerging. Many of these live through the entire season and hibernate again in the autumn, the usual heavy mortality among adults in the spring being probably among those that have survived two winters.

Among predaceous enemies of the larvae are the ants, *Camponotus pennsylvanicus*, DeG., *Myrmica punctiventris*, Roger, *Lasius americanus*, Em., *Cremastogaster lineolata*, Say, and *Solenopsis debilis*, Mayr.

The Hymenopterous parasite, *Anaphoidea conotracheli*, Gir., a well-known egg-parasite of the plum curculio, *Conotrachelus nenuphar*, Hbst., has been found to destroy about 40 per cent. of the eggs. Adult parasites issue in from 10–13 days after oviposition, thus allowing for the development of 4 or 5 successive generations. The larva of another parasite, *Microbracon mellitor*, Say, attacks the larva externally and devours it, after which it constructs within the grape a small cocoon from which the adult parasite escapes within a few days. A third Hymenopteron, *Stiboscopus brooksi*, Ashm., oviposits within

the cocoon, and a single specimen of another parasite, *Triaspis curculionis*, Fitch, was reared from this pest in 1917.

The feeding habits of the beetles render them peculiarly susceptible to arsenical sprays, complete freedom from attack being obtained by spraying twice with lead arsenate at a strength of 3 lb. paste to 50 U.S. gals. water, just after the blossoms have dropped and again 3 or 4 weeks later. Enclosing the clusters of fruit when about one-fourth grown in 1 lb. or 2 lb. paper bags also affords complete protection, though this procedure is slower and more expensive than spraying, and the results are little, if any, better. Partial control may be effected by cultivation of the soil under infested grape-vines so as to break up the cocoons, or by collecting the adults on cloudy days or in the early morning by shaking them on to sheets beneath the vines.

BROOKS (F. E.). **The Grape Root-borer.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 730, 24th December 1918, pp. 21–28, 3 plates.

The Aegeriid moth, *Paranthrene* (*Memythrus*) *polistiformis*, Harris (grape root-borer), is particularly inconspicuous in all its stages and is probably a more widespread and serious enemy of grapes than has been commonly supposed. Grape-vines are rarely killed outright by the borers, but linger for years, making meagre annual growth, and bearing reduced crops of fruit, they being, so far as known, the only plants attacked by this insect. Injury is due exclusively to the burrows made by the larvae in the roots, those half an inch or more in thickness being girdled or entirely eaten off.

The eggs, which are deposited singly, or in groups of 2–5 on the canes or leaves of the vines, or more frequently on grass, weeds or straws under the vines, hatch in from 18–23 days, the larvae at once burrowing into the ground and attacking the roots. The larval period occupies nearly two years, hibernation taking place in a roomy chamber at the end of a burrow. Pupation occurs in June and early July at the surface of the ground and extends over a period of about four weeks. The adults emerge on bright warm days usually about the middle of the forenoon, oviposition beginning the following day and continuing for about a week.

No parasites of this species are known. Ants have been seen carrying the eggs, the larva of a fire-fly beetle, *Photuris pennsylvanica*, DeG., has been found devouring the pupa, and the crested flycatcher, *Myiarchus crinitus*, has been observed catching moths on the wing.

The use of insecticides and the worming process are not of practical application against this species, and even soil fumigants are of doubtful value owing to the large area over which the borers feed. The most valuable measure is the application of cultural methods to induce a vigorous and rapid growth, the free use of fertilisers being especially important.

LEACH (B. R.). **Experiments in the Control of the Root Form of the Woolly Apple Aphis.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 730, 24th December 1918, pp. 24–40, 3 plates, 1 fig.

The author's summary of this paper is as follows:—Carbon bisulphide, in solution at the rate of one-half ounce to 4 U.S. gals. water and applied at the rate of ¾ gal. per square foot of soil, will control the root form of the woolly aphis, *Eriosoma lanigerum*, under

suitable soil conditions. The liquid is best applied by preparing shallow basins about the tree and should be used only when the soil is in a moist condition. The solution is best prepared by pouring the carbon bisulphide into the water and agitating vigorously. The carbon bisulphide thereby breaks up into small globules, some going into solution and the remainder forming a mechanical mixture with the solution. The gas diffuses laterally and vertically only as far as the liquid penetrates, and therefore every square foot of infested soil must be subjected to the action of the solution in order to insure complete control. When used at the foregoing rate the carbon bisulphide produced no injury to the roots of apple. The treatment may be made at any time during the growing season except during the period of 2 or 3 weeks in the spring when the trees are budding.

In orchard practice the solution is best applied by using a power spraying outfit and two auxiliary tanks.

The advantages of this method are, firstly, the even diffusion of the liquid and complete Aphid mortality in the soil area treated and, secondly, the safety with which the bisulphide can be used. The disadvantages of the method are, firstly, the huge amounts of water required, with consequent high cost of labour; secondly, the difficulty, on any but level ground, of preparing basins with level floors, thus insuring the proper distribution of the liquid over the area to be treated; and thirdly, the wide area of infested roots on older trees, every square foot of which must be treated with the liquid. This last condition precludes the use of carbon bisulphide except on small trees with restricted root areas.

Sodium cyanide at the rate of ½ oz. to 4 U.S. gals. water did not kill the Aphids in the lower-soil depths, even when a superabundance of solution per square foot was employed. No injury to apple roots resulted when the material was used at this strength. The only advantage this chemical possesses, as compared with carbon bisulphide, is its ready solubility in water. On the other hand, its uncertainty in producing Aphid mortality in the lower soil levels, together with its extremely poisonous nature, precludes its use in practice.

When kerosene emulsion is applied to the soil it disintegrates into its component parts; the first inch of surface soil retains the soap and some of the kerosene content; the next 4 inches of the soil retains almost all the remainder of the kerosene. Kerosene emulsion, therefore, does not kill the Aphids in the lower soil levels and the cost of preparing the quantity necessary for soil treatment renders it of little value. The application of this material to apple roots, in the writer's experience, results in severe injury to the tree.

Deep planting will not prevent woolly aphis infestation and results in the death of many trees so planted, owing apparently to the inability of the root systems to function properly under these conditions.

AMARI (S.). **Sanji, Sanyo, Sanga ni kiseisuru Dani *Pediculoides* ni kwansuru Konkyu. Dai ni Ho.** [Studies on the Mite, *Pediculoides*, parasitic on the Silkworm, Pupa and Moth. Part II.]—*Sangyo Shikenio Hokoku* [*Report of the Sericultural Experiment Station*], *Tokyo*, iii, no. 6, 16th September 1918, **pp. 339–370, 1 map.**

The fact that the serious disease of silkworms commonly called "mite-disease" is due to infestation by the females of a species of

Pediculoides has been recorded in an earlier paper by this author. The disease is so virulent that silkworms are killed by it within a few hours of infection. This report describes investigations as to the true origin of the disease and experiments as to whether it is caused by mechanical action, interference with nutrition, or the presence of bacteria or toxic substances introduced by the mite, especially the last two, as being the most probable. Injections of the body fluid of infected silkworms into healthy ones proved negative. Nothing was revealed by microscopical examination, nor were any bacteria obtained from cultivations on agar-agar. It is therefore concluded that the disease is not due to bacterial or bacillary action.

Experiments were then made with an extract from the larvae of this mite in salt solution. Injections of this extract proved toxic to silkworms of the fifth instar in periods varying from 23 to 63 hours. The author is therefore of opinion that the disease is unquestionably due to toxic substances contained in the body of the mite and this view was confirmed by further experiments which showed that 0·50 gr. of a 1 per 100 solution of dead mites and 4 c.c. of physiological salt solution (0·85 per cent.) is fatal to silkworms, while a 1 per 1,000 solution is not so. It was further found that the extract lost its virulence when kept at a temperature of 100° C. [212° F.] for five hours. The toxic action of the virus also varies with the atmospheric conditions, death taking place more quickly when the temperature is high.

This mite also attacks the human skin, causing dermatosis, with symptoms of severe itching and reddish swellings with white centres. In severe infestations the affected part becomes swollen, and fever occurs.

The mites are also found in abundance in grain, whether barley, wheat or rye, and one case was observed in which the caterpillar of a grain moth was infested with them. They are widely distributed in Japan.

AMARI (S.). **Bakuriu chu no *Tarsonemus* Dani no Keitai.** [The Morphology of *Tarsonemus* found in Barley Grain.]—*Sangyo Shikenjo Hokoku.* [*Report of the Sericultural Experiment Station.*] *Tokyo*, iii, no. 6, 16th September 1918, pp. 371–376, pl. xxix.

A description is given of a mite, a species of *Tarsonemus*, found in grains of barley, which has a close resemblance to the species of *Pediculoides* infesting silkworms. Its morphology is described in detail and the points distinguishing it from the latter species are given.

CHINO (M.). **Tento-mushi no Heni ni kuwansuru Kenkyu.** [Researches on the Variation of the Coccinellid (*Ptychanatis axyridis*, Pall.).]—*Shinano Kyoiku* [*Education in Shinamo*], *Shinamo*, Year 7, October 1918, pp. 1–9, 9 figs.

Though this paper mainly discusses the variation and inheritance of the wing-markings of *Ptychanatis axyridis*, Pall., some remarks on the life-history of this Aphid-destroying Coccinellid are appended. The eggs are usually laid in masses on the upper side of the leaf and occasionally on branches or on the bark. They are spindle-shaped, being pale yellow at first and orange-yellow later. They usually hatch

about a week after deposition. The larva has four moults, and becomes mature in from two to three weeks. The reddish pupa is suspended by the end of its abdomen from a leaf. The beetle hibernates as an adult, and becomes active from the end of April to the beginning of May. The adults of the next generation appear in the middle of June, and after this, the generations become quite irregular and two or three broods may occur before hibernation takes place.

It is infested by two parasitic flies; one attacks the hibernating adults, the larva appearing in March or April and soon pupating, and the adult fly emerging at the end of May; the other infests the pupa, and the fly appears in June. Possibly this species has several generations in a year.

TAKAHASHI (S.). **Rokushu Tengyu Yochu no Kohiban no Hammon no Kenkyu oyobi Heiju wo gaisuru Tengyu ni tsukite.** [On the Patterns of the Prothoracic Shields of six Species of Cerambycid Larvae and on the Cerambycid boring in Apple-trees.]—*Konchu Sekai* [*Insect World*], *Gifu*, xxii, no. 12, 15th December 1918, pp. 9–13, 1 fig.

The author describes the specific differences displayed in the prothoracic shields of the larvae of six species of Cerambycids, viz.:—*Apriona rugicollis*, Chevr., *Melanauster chinensis*, Forst., *Chreonoma fortunei*, Thoms., *Oberea japonica*, Thunb., *Xylotrechus pyrrhoderus*, Bot., and *Thyestes gebleri*, Fald. He also states that though *Oberea japonica* has been thought to be an important apple-tree borer in Japan, the damage it does should really be attributed to *Apriona rugicollis*, which also attacks mulberries.

NAITO (M.). **Kuwa ni kiseishi Chuei wo tsukuru Tamabai no Isshu Kuwakuro-tamabai (*Diplosis morivorella*, Naito).** [*Diplosis morivorella*, Naito, a Gall-making Cecidomyid infesting the Mulberry.] —*Sangyo Shimpo* [*Journal of the Silk Industry*], *Tokyo*, Year 27, no. 310, 1st January 1919, pp. 29–31, 1 plate.

The author has discovered on the mulberry-tree a new gall-making Cecidomyid, which is here described as *Diplosis morivorella*. The galls are greenish, plum-shaped, of a length of 5–9 mm. and are found in groups at the base of new buds or on the stalks of the basal leaves of young shoots. The larvae usually appear at the end of May and pupate at the beginning or middle of June within the gall. The adults appear from the middle of June to the beginning of July and oviposit in the buds; they live about a week after emergence. From two to twenty eggs are laid by a fly in a single bud. Infested buds may fail to develop, but as it is the basal, and not the apical ones that are attacked, the total injury may not be serious.

OKADA (T.). **Takenoko no Gaichu Hajimakuchiba ni tsuite.** [On *Polydesma vulgaris*, **Butl., a Pest of Bamboo Shoots.**]—*Konchu Sekai* [*Insect World*], *Gifu*, xxiii, no. 1, 21st January 1919, pp. 11–17, 1 fig.

The market-price of bamboo is rising every year, but unfortunately the bamboo forests in the Prefecture of Shidzuoka are greatly

injured by the bamboo shoot borer, *Polydesma vulgaris*, Butl., the damage done amounting to from 30 per cent. to 80 or 90 per cent. The variety of bamboo most liable to injury, "Kuchiku," is unfortunately also the most useful, the other species, except "Medake," being free from the pest. The larvae infest the bamboo shoot when it is from one to two feet long, and from one to ten individuals or more may be found in a single shoot. When attacked, the shoots become yellowish in colour and wither, barely reaching a length of 4 or 5 feet. The first attack usually occurs from the middle of June to the beginning of July. The fully grown larva leaves the shoot and pupates under the ground. The adult moth appears at the end of July and beginning of August, and in the middle of the latter month lays round milky-white eggs in rows on the bamboo leaf. The winter is passed in this stage, and there is only one brood in a year. There has been much difference of opinion amongst entomologists as regards the life-history of this pest, since the eggs hatch in May at a time when the ordinary bamboo shoots have not yet appeared, and the larva afterwards found within the shoot is always well developed and of a length of 10–15 mm. The present author states that the earliest larval stages are spent in the slender early shoots of various species of bamboo in the forest, and that later migration occurs to the shoots of the ordinary variety, which are entered by boring into the apex. This habit suggests a possible remedial measure, in that the removal of the early slender shoots from the bamboo forest may check this pest effectually. Experiments in this direction are being conducted by the author.

MURAMATSU (S.). **Oni juyahoshi no Keikwa.** [The Life-History of *Epilachna niponica*, Lew.]—*Konchu Sekai* [*Insect World*], *Gifu*, xxiii, no. 1, 21st January 1919, pp. 17–20.

The Coccinellid, *Epilachna niponica*, Lew., has three broods a year. It passes the winter in the adult stage and becomes active at the beginning of May, ovipositing at the end of the month. The adults of the second generation appear in the middle of June and those of the third from the end of July to the beginning of August. The beetles that will eventually hibernate are found in September. The adult hides beneath the foliage by the day and becomes active in the early morning and evening. This beetle attacks potatoes, egg-plant, tomatoes, etc., throughout Korea. A mixture of soap solution and insect powder is the most effective remedy against it.

TAKAHASHI (S.). **Daima no Gaichu to Daima-Iengyu ni tsukite.** [Notes on Insects injurious to Hemp and on *Thyestes gebleri*, Fald.]—*Konchu Sekai* [*Insect World*], *Gifu*, xxiii, no. 1, 21st January 1919, pp. 20–24, 2 figs.

The author records 13 species of insects injurious to hemp, viz., *Thyestes gebleri*, Fald., *Haltica flavicornis*, Baly, *Barathra brassicae*, L., *Pyrausta nubilalis*, Hb., *Hepialus excrescens*, Butl., an undetermined Tortricid, *Acronycta consanguis*, Butl., *Rhinonchus pericarpius*, L., *Mordellistena cannabisi*, Mots., *Tettigonia ferruginea*, F., var. *apicalis*, Walk., *Geisha distinctissima*, Walk., *Ricania japonica*, Melich., and *Aphis* sp. Of these the first three are the most destructive.

The Longicorn, *Thyestes gebleri*, has one annual generation; it winters in the larval state, pupates in all probability in May and appears as an adult in June. The eggs are laid in the hemp stalk, usually 5 inches below the first joint, one or occasionally two being deposited in each. The larva gradually descends the stalk as it matures, eating out the interior as it goes and making an aperture from 5 to 8 inches from the ground through which the excrement is ejected. The best remedial measure is the burning of infested stalks.

WEISS (H. B.) & DICKERSON (E. L.). **The European Mole Cricket, *Gryllotalpa gryllotalpa*, L., an Introduced Insect Pest.**—*Jl. New York Entom. Soc., Lancaster, Pa.*, xxvi, no. 1, March 1918, pp. 18–23, 1 plate.

The European mole-cricket, *Gryllotalpa gryllotalpa*, was first observed in America in New Jersey, where it had evidently been introduced with imported nursery stock. Though probably only slightly vegetarian it does much damage to root crops, and though it may prey on underground insects, the damage done in fields and orchards outweighs its beneficial action.

Its control has been attempted by the use of poisoned baits containing arsenic or phosphorus placed in the burrows or scattered on the ground before seeding time; by injecting into the burrows some substance such as naphtha, petroleum, a 25 per cent. emulsion of petroleum, soapy water or calcium carbide from which acetylene gas is liberated by the action of the moisture present; by trapping the insects by means of a pot sunk into the soil and covered with a board, or by means of holes filled with manure or vessels filled with water placed in the soil; by placing substances such as lime on the surface at the rate of 16 cwt. to the acre, or by the introduction of naphthaline into the soil as it is being tilled; and by destroying the nests of the insects.

NICOLAY (A. S.) & WEISS (H. B.). **A Review of the Genus *Buprestis* in North America.**—*Jl. New York Entom. Soc., Lancaster, Pa.*, xxvi, no. 2, June 1918, pp. 75–109, 1 plate, 2 figs.

The larvae of the BUPRESTIDAE are miners in the tissue of dead, dying and living plants and are of two general types, the bark- and wood-borers, and the leaf-miners. Eggs are deposited singly during the spring and summer in crevices in the bark, or under the bark at the edge of a wound, and the larva mines until the following or second autumn, when it pupates and transforms to the adult. The insect hibernates in the larval, pupal or adult stage and in nearly all cases the adult emerges the following spring or summer. The adult beetles usually feed on the foliage, sometimes, but not necessarily, on that of the larval host.

A key is given to the 24 species here dealt with, including:—*B. aurulenta*, L., breeding in Douglas fir, various pines and western red cedar (*Thuja plicata*); *B. adjecta*, Lec., a local species breeding in pines; *B. sulcicollis*, Lec., in white and pitch pine; *B. striata*, F., in *Pinus strobus*, *P. rigida* and probably all southern yellow pines; *B. apricans*, Hbst.; *B. decora*, F.; *B. salisburyensis*, Hbst., in *Pinus rigida*; *B. maculiventris*, Say, in balsam and spruce; *B. maculipennis*,

Gory; *B. lineata*, F., feeding on *Pinus strobus* and *P. rigida*; *B. nuttalli*, Kirby, in pine; *B. laeviventris*, Lec., in *Pinus ponderosa*, and other pines; *B. confluenta*, Say, attacking planted cotton wood; *B. rufipes*, Oliv., breeding in oak, beech, maple and southern yellow pine; *B. viridisuturalis*, sp. n.; and *B. gibbsi*, Lec., probably breeding in oak and poplar. [See also this *Review*, Ser. A, vi, pp. 289, 421].

Osservatorio Autonomo di Fitopatologia, Turin, Mthly. Leaflets, Nos. 1–12, January-December 1918, 46 pp.

The following is a brief record of some of the injurious insects reported during the year:—Lepidoptera: *Aegeria* (*Sesia*) *apiformis* on poplar; *Cydia* (*Carpocapsa*) *pomonella* on pear; *C. splendana* on walnut and chestnut; *C. funebrana* on prune; *Cnethocampa pityocampa* on pine; *Cossus cossus* on walnut, elm, birch, and lime; *Hyponomeuta malinellus* on apple; *Cirphis* (*Leucania*) *zeae* on maize; *Malacosoma neustria* on apple and pear; *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*) on chestnut, pear, cherry and elm; *Polychrosis botrana* and *Clysia ambiguella* on vine; *Pieris brassicae* on cabbage; *Porthetria* (*Lymantria*) *dispar* on pear and plum; *Saturnia pyri* on pear and poplar; *Sitotroga cerealella* and *Tinea granella* in stored wheat; and *Zeuzera pyrina* (*aesculi*) on apple.

Coleoptera: *Agriotes lineatus* on wheat, potato and turnip; *Anthonomus pomorum* on pear; *Ceuthorrhynchus sulcicollis*, Payk., on cabbage; *Capnodis tenebrionis* on *Prunus spinosa*; *Hylesinus fraxini* on cherry; *Haltica oleracea* on cabbage; *Bruchus lentis* in lentils; *B.* (*Laria*) *pisorum* in peas; *Byctiscus betulae* (*Rhynchites betuleti*) on vine; *Saperda carcharias* on poplar; *Xyleborus dispar* in apple and pear; and *Scolytus* (*Eccoptogaster*) *multistriatus* on elm.

Hymenoptera: *Eriocampoides* (*Caliroa*) *limacina* on pear and *Hoplocampa brevis* on pear.

Rhynchota:—*Stephanitis* (*Tingis*) *pyri* on pear. COCCIDAE:—*Aulacaspis rosae* on rose; *A. pentagona* on lemon, *Euonymus*, jasmine, lilac, mulberry, oleander, *Celtis australis* and *Juglans nigra*; *Aonidia lauri* on laurel; *Aonidiella taxus*, on *Podocarpus*; *Aspidiotus hederae* on oleander and mandarine; *Ceroplastes rusci* on fig; *C. sinensis* on mandarine; *Coccus hesperidum* on lemon; *Epidiaspis piricola* on pear; *Eulecanium persicae* on laurel, lilac and *Elaeagnus angustifolia*; *Icerya purchasi* on lemon; *Lepidosaphes beckii* (*Mytilaspis citricola*) on vine; *L. ulmi* (*M. pomorum*) on pear and willow; *Pseudococcus longispinus* on *Chamaedorea oblongata*; *P. citri* on lemon; *Pulvinaria vitis* on vine and hawthorn; *P. camelicola* on camellia. APHIDAE:—*Aphis persicae* on peach; *A. ribis* on currant; *A. cucurbitae* on pumpkin; *A. rumicis* (*papaveris*) on chrysanthemum and beans; *Anuraphis persicae-niger* on peach; *Chermes strobi* on *Pinus strobus*; *Dryaphis longipes* on chestnut; and *Hyalopterus arundinis* (*pruni*) on prune and peach.

Diptera: *Acidia heraclei* on celery; *Contarinia pyrivora* on pear; *Hylemyia antiqua* on onion and garlic; *Platyparea poeciloptera* on asparagus; and *Perrisia pyri* on pear.

Orthoptera:—*Gryllotalpa gryllotalpa* on potato and lettuce.

Mites: *Eriophyes pyri* on pear; *E. vitis* on vine; *E. tristriatus* on walnut; and *Tetranychus telarius* on vine and angelica.

Reh (L.). Zur Ausgestaltung der angewandten Entomologie in Deutschland. [The Development of Applied Entomology in Germany.]—*Zeitschr. f. angew. Entomologie, Berlin*, ii, no. 1, 1915, pp. 225–228. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 3–4, 1st June 1918, p. 158.)

The view is expressed that the development of applied entomology in Germany should proceed along the lines of scientific research, practical work and teaching. For research, institutes are required with modern equipment and placed under the control of a zoologist or entomologist and not, as hitherto the case in Germany, under a botanist. Practical work requires field-stations such as are found in the United States. Teaching must be closely related to practice, and field-stations must therefore be added to existing instruction centres. Liberal financial assistance must be given where applied entomology is concerned, in view of the enormous losses due to the ravages of insects.

Reh (L.). Düngung und Insektenbefall. [Manuring and Insect Infestation.]—*Zeitschr. f. angew. Entomologie, Berlin*, iii, 1916, pp. 127–133.

Hoffmann (—). Düngung und Insektenbefall. [Manuring and Insect Infestation.]—*Ibidem*, 257–262. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 3–4, 1st June 1918, pp. 158–160.)

Both these papers discuss the effects of manure on insect pests. A case is recorded of a severe outbreak of *Hyponomeuta malinellus* and *H. variabilis* in which trees standing in grassland were less infested than those in cultivated ground, and under similar conditions of cultivation manured trees suffered the most. The opinion is expressed by the first author that cultivated plants are preferred by insects to wild ones and that sometimes this preference is shown for cultivated plants very different from the original wild food-plant. Cultivation on a large scale has been held to be the reason for the increase in infestation, but this does not explain why the plants that are most carefully grown, such as the finest varieties of the apple, should suffer most. Young, growing plants are also preferred, and the use of trap-crops depends on this fact.

Regarding the influence of various manures on plants, stable manure or any manure containing nitrogen, such as saltpetre, increases the water-content of plants and makes them richer in albumen and starch. Fruit-trees thus manured are particularly liable to canker and to infestation by Aphids, Coccids and red spider [*Tetranychus*]. Lime and phosphorus on the contrary reduce the number of insect pests. It is therefore necessary to ascertain in the case of each pest which manures are favourable or otherwise to its increase.

Scheidter (F.). Tierische Schädlinge an Geholzen. [Insect Pests of Forest Trees.]—*Mitt. Deutsche Dendrol. Gesellsch.*, 1916, pp. 210–225, 13 plates. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 3–4, 1st June 1918, pp. 160–162.)

Much damage is recorded to the leaves of sugar-maple by the adults of *Phyllobius psittacinus*, Germ., and the larvae of this beetle were even more harmful in spruce plantations by destroying the bark of the entire root-system. The adult beetles seldom attack conifers.

Remedial measures are not required in large forests, but collection by jarring may be practised in gardens. To get rid of the larvae in nursery beds the plants must be lifted and transplanted, and the old beds dug up and the larvae crushed. As the maple, alder and service tree are favourite food-plants of *P. psittacinus*, their vicinity should be avoided when laying out gardens. Oviposition may be prevented by covering the beds with a thick layer of quicklime. The oak scale, *Asterolecanium variolosum*, Ratz. (*quercicola*, Bch.), chiefly attacks young oaks, and in bad cases branches or young stems may be killed, the bark being loosened and falling off. On the trunks of older trees the bark is only deformed. If infestation is severe and extensive, the trees must be cut down level with the ground ; single trees should be painted with a wash. The infestation of willows by the gall-midge, *Rhabdophaga* (*Cecidomyia*) *saliciperda*, Duf., attracts tits and woodpeckers in search of the larvae and these birds severely damage the bark and bast. In a forest near the Rhine and liable to inundation the Scolytid beetles, *Hylesinus fraxini*, F., *H. oleiperda*, F., *H. crenatus*, F., and *H. orni*, Fuchs, especially the two first-named, injured trees weakened by floods. *H. oleiperda* continued to spread northwards. Larch shoots are killed by the larva of *Cecidomyia kellneri*, Hensch., which is common in Upper Bavaria and in the Alps extends right up to the limit of larch. In the case of single trees the buds may be cut off and burnt. *Coleophora laricella*, Hb., is another pest of larch that can be combated in isolated cases only ; the pupal cases in which the moth has hibernated must be collected year after year. Swellings of the buds of *Abies arizonica* are not due to mites, as has been stated, but to infestation by *Chermes piceae*, Ratz. Such swellings are also found in *Abies pectinata*, *A. concolor*, *A. nobilis* f. *glauca*, *A. sibirica* and *A. fraseri*. The spring generation may be checked by painting the bark with a wash.

Escherich (K.). **Hopfenschädlinge.** [Hop Pests.]—*Zeitschr. f. angew. Entomologie, Berlin*, iii, 1916, pp. 311–313. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 3–4, 1st June 1918, p. 162.)

The hop aphis, *Phorodon humuli*, Schrk., was abundant in 1916 in the Upper Bavarian hop district, the leaves everywhere showing the characteristic deformation. Natural enemies were present in large numbers, including *Coccinella bipunctata*, *C. quinquepunctata*, Syrphid larvae and *Forficula* spp. Spraying was effected with a 1–2 per cent. soap solution to which a small quantity of either petroleum, tobacco extract or barium chloride had been added. Flea-beetle injury was also widespread, and was more marked where hop-poles were still used. A still more important factor is the date of planting. If this is carried out early in the spring the injury is lessened.

Zacher (F.). **Neue und wenig bekannte Pflanzenschädlinge aus unseren Kolonien.** [New and little known Plant Pests from our Colonies.]—*Zeitschr. f. angew. Entomologie, Berlin*, iii, 1916, pp. 418–425. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 3–4, 1st June 1918, pp. 163–164.)

A new Psyllid, *Trioza bussei*, is recorded as forming galls on *Kicksia* in a rubber plantation in Kamerun. Orthopterous pests of tobacco

collected in Kamerun included: *Heteropternis* sp., *Euprepocnemis* sp., *Atractomorpha* sp. and *Scapsipedus marginatus*, Afz. Another tobacco pest is a Tenebrionid beetle, *Gonocephalum simplex*, F.

Andres (A.). **Die wichtigsten Baumwollschädlinge Ägyptens unter besonderer Berücksichtigung ihres etwaigen Vorkommens in der Turkei.** [The most important Cotton Pests of Egypt with particular Reference to their possible Occurrence in Turkey.]—*Zeitschr. f. angew. Entomologie, Berlin*, iii, 1916, pp. 403-417. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 3-4, 1st June 1918, p. 164.)

The increasing cultivation of cotton in Turkey favours the introduction of pests of this plant, and a list is here given of those that occur in Egypt, including *Prodenia litura*, *Earias insulana*, *Pectinophora* (*Gelechia*) *gossypiella*, and the less important *Schistocerca peregrina*, *Oxycarenus hyalinipennis* and *Aphis gossypii*.

Bolle (J.). **Der volle Erfolg der biologischen Bekämpfung der Schildlaus des Maulbeerbaumes (*Diaspis pentagona*, T. T.)** [The Complete Success of Biological Control of the Mulberry Scale, *Aulacaspis pentagona*.]—*Zeitschr. f. angew. Entomologie, Berlin*, iii, 1916, pp. 124-126.—(Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 3-4, 1st June 1918, pp. 167-168.)

An example of the successful control of *Aulacaspis pentagona* by means of *Prospaltella berlesei* is recorded, the procedure adopted having been already described [see this *Review*, Ser. A, ii, p. 526].

Weiss (J. E.). **Einfluss der Witterungsverhältnisse auf das Auftreten von Pflanzenkrankheiten und tierischen Schädlingen 1916 und 1917. III. Tierische Schädlinge.** [The Influence of Weather on the Occurrence of Plant Diseases and Insect Pests in 1916 and 1917. III. Insect Pests.]—*Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 5, 6th August 1918, pp. 201-208.

The conclusions reached are that weather has no influence on *Eriocampoides limacina*, *Typhlocyba rosae*, *Tetraneura ulmi* and *Eriophyes similis*. Winter cold was injurious to *Lyonetia clerkella*, *Coptodisca splendoriferella*, *Phytomyza vitalbae*, *Neuroterus quercus-baccarum*, *Pontania femoralis*, *Ceuthorrhynchus sulcicollis*, *Eriophyes pyri*, *E. vitis*, *E. tiliae* var. *liosoma*, *E. pseudoplatani*, and *E. tristriatus* var. *erineus*. The dry and warm summer of 1917 favoured *Tetranychus telarius*.

Kornauth (K.). **Bericht über die Tätigkeit der k. k. landw.-bakter. und Pflanzenschutzstation in Wien im Jahre 1916.** [Report of the Royal and Imperial Agricultural, Bacteriological and Plant-Protection Station in Vienna in 1916.]—*Zeitschr. f. d. landw. Versuchswesen in Oesterreich*, xx, 1917, pp. 288-314. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 5, 6th August 1918, pp. 213-214.)

Breeding experiments with *Ephestia kühniella* (flour moth) showed that two generations occur, the first in May and the second in

September. An Ichneumonid parasite of this pest, *Campoplex frumentarius*, Rond., was frequently observed. Beans in Moravia were infested by the Anthomyiid, *Phorbia* (*Chortophila*) *trichodactyla*, Rond.

Linsbauer (L.). **Tätigkeitsbericht des botanischen Versuchslaboratoriums und des Laboratoriums für Pflanzenkrankheiten der k. k. höheren Lehranstalt für Wein- und Obstbau in Klosterneuburg f. 1916-1917.** [Report for 1916–1917 of the Botanical Experimental Laboratory and of the Plant-Disease Laboratory of the Royal and Imperial Superior Institute for Vine and Fruit Culture in Klosterneuburg.] — *Vienna*, 1917. (Abstract in *Zeitschr. f. Pflanzenkrankh.*, *Stuttgart*, xxviii, no. 5, 6th August 1918, pp. 215–216.)

The pests recorded include the pear gall-midge, *Contarinia pyrivora*, and the mite, *Eriophyes vitis*, which damages the foliage of vines especially in dry springs. *Eriococcus araucariae* was found on *Araucaria*, and *Aspidiotus hederae* on *Aucuba japonica* in pots.

Shander & Krause (F.). **Die Krankheiten und Schädlinge des Flachses.** [Diseases and Pests of Flax.]—*Abteilung für Pflanzenkrankheiten des Kaiser Wilhelm Instituts, Bromberg*, Flugblatt no. 27, July 1917.

Shander & Krause (F.). **Die Krankheiten und Schädlinge des Hanfes.** [Diseases and Pests of Hemp.]—*Ibidem*, Flugblatt no. 28, August 1917. (Abstracts in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 5, 6th August 1918, p. 218.)

The insect pests of flax mentioned in the first of these circulars are *Thrips lini*, *Tylenchus devastatrix*, *Tetranychus* sp. and *Phalonia* (*Conchylis*) *epilinana*.

The hemp pests are *Pyrausta* (*Botys*) *nubilalis*, *Tetranychus telarius* and *Agromyza strigata*.

Bücher (—). **Zusammenfassender Bericht über die Heuschreckenbekämpfung in Anatolien, Syrien und Palästina im Jahre 1916.** [A comprehensive Report on Anti-Locust Work in 1916 in Anatolia, Syria and Palestine.]—*Tropenpflanzer, Berlin*, xx, 1917, pp. 373–387. (Abstract in *Zeitschr. f. Pflanzenkrankh.*, *Stuttgart*, xxviii, no. 5, 6th August 1918, p. 238.)

In 1915 Anatolia, Syria and Palestine suffered greatly from invasions of the locusts, *Schistocerca peregrina*, *Calliptamus* (*Caloptenus*) *italicus* and *Dociostaurus* (*Stauronotus*) *maroccanus*. The first-named comes from Africa, survives for one or two generations and then dies out owing to the unfavourable climate. This also applies to *C. italicus*, but *D. maroccanus* is indigenous in the mountain districts, whence enormous swarms, sometimes measuring 15 miles in length by over 600 yards in breadth, invade the plains. The eggs are laid from July to August and hatching begins in mid-February.

The anti-locust campaign organised by the author was conducted by a staff of 14 directors, 72 officers, 2,000 supervisors, about 11,000 men from the labour battalions and compulsory levies from the population.

In western Anatolia an average of 450,000–500,000 workers were daily employed from March to May. The Cyprus system of barriers was largely adopted and about 6,000 tons of eggs and 11,000 tons of locusts were collected. Arsenic and Paris green were tried and suitable baits were sawdust, chopped lucerne, chopped grass and cowdung, salt being added to all of these. No practical results were obtained with fungus diseases or bacterial infections. In the plains the losses were reduced from 40–50 per cent. to 6–10 per cent. For 1917, 250 non-commissioned officers and 2,500 men were detailed as instructors and 600,000 metres of zinc barriers and 50 tons of arsenic and Paris green were ordered.

BOLLOW (—). **Drei märkische *Leucopis*-Arten aus Cocciden (*Eriopeltis*) an *Festuca* gezogen.** [Three Species of *Leucopis* parasitising Coccids (*Eriopeltis*) on *Festuca*.]—*Deutsch. Entom. Zeitschr.*, 1917, pp. 173–174. (Abstract in *Zeitschr. f. Pflanzenkrankh., Stuttgart*, xxviii, no. 5, 6th August 1918, p. 240.)

In an infestation of *Festuca* sp. by *Eriopeltis lichtensteini*, Sign., about 60 per cent. of the scales were parasitised by several Chalcids and by *Leucopis nigricornis*, Egg. *Leucopis annulipes*, Zett., was bred from *Eulecanium* (*Lecanium*) *corni*, Bch., and other scales, from the gall of *Cynips terminalis* and from *Hyalopterus arundinis*, F. A third species, *L. puncticornis*, Meig., was obtained from a scale on *Festuca*, from galls of *Rhabdophaga rosaria*, L., and from Aphids.

FISCHER (C. E. C.). **Cause of the Spike Disease of Sandal (*Santalum album*).**—*Indian Forester, Allahabad*, xliv, no. 12, December 1918, pp. 570–575.

A sound working hypothesis of the cause of spike disease in sandal is that it is due to ultra-microscopic organisms which either prevent the formation of the necessary starch-converting enzyme, or at least inhibit its action. The fact that the disease may appear at a distance, leaving an intervening area uninfected, necessitates the further supposition that it is disseminated by winged sucking insects, a view that has been held since 1904.

WILLCOCKS (F. C.). **The Insect and Related Pests of Egypt. Volume I. The Insect and Related Pests Injurious to the Cotton Plant. Part I. The Pink Bollworm.**—*Sultanic Agric. Soc., Cairo*, 1916, 339 pp., 10 plates, 17 figs. [Received 3rd February 1919.]

The present volume is intended to form the first of three dealing with the insect pests of Egypt and has been published in advance of any other part of the material collected in view of the importance assumed during recent years in Egypt by the pink bollworm *Pectinophora* (*Gelechia*) *gossypiella*. It is impossible in the present state of knowledge regarding this moth to give anything approaching a complete account of its life-history and habits; the present report only claims to be a preliminary discussion of the pink bollworm problem in Egypt, giving the author's view of the question. Artificial means of control are discussed at length [see this *Review*, Ser. A, ii, 218, 324, iii, 505, iv, 230, 472, 491, vi, 42].

Predaceous enemies of the pink bollworm include a bug, *Triphleps* sp., which destroys the eggs, and ants, which attack the bollworm whenever they can do so, though they are rarely present in the cotton-fields. Probably the bollworms emerging from stored cotton seed in June and July and again in September and October suffer most from these attacks. The mite, *Pediculoides ventricosus*, Newp., is a common enemy of the resting stage of *P. gossypiella* in cotton seed. This mite is viviparous, producing from a few to 270 living young. At a temperature of 90° to 100° F. only six days are required from the time of birth to reproduction of another generation; from 60° to 70° F., thirteen days are required; while below 50° F. the mites apparently cannot develop. During January and February in Egypt the life-cycle occupies about 6 weeks. As many as 160 mites have been observed on a single larva of *P. gossypiella*. Bollworms killed by the mites frequently exhibit numbers of dark brown or black spots where the mites have fed. It is doubtful whether this mite can become of much importance as a parasite of *P. gossypiella* [see this *Review*, Ser. A, ii, p. 508], as it is incapable of reaching the bollworm when enclosed in a cotton boll, and also because the temperature during the Egyptian winter is not high enough for its development. A Rhizoglyphid mite has also been observed on larvae of *P. gossypiella*, but it is doubtful whether any serious harm results. A number of spiders and certain birds, as well as toads and frogs, probably exercise some measure of control over the numbers of *P. gossypiella*.

A true parasite of the pink bollworm is *Pimpla roborator*, the female of which oviposits through the lock of dead cotton into the cocoon of the bollworm, and stings the latter into insensibility preparatory to depositing a single egg on the outside of the cocoon. At from 65° to 70° F. the incubation period is four days and the larva begins to feed upon its host immediately after hatching. After about 9 days, during which two moults occur, the larva is mature, and pupates probably within the cocoon of its host, the adult emerging twelve days later. A table records the life-cycle of a number of individuals bred in the laboratory showing a duration of from 30 to 45 days. *P. roborator* is apparently parthenogenetic. Its numbers are checked by the fact that many individuals may oviposit in the same host, and also by the fact that eggs may be deposited and development occur in a larva of its own species. This self-parasitism is apparently responsible for the death of many larvae found in the cocoons of pink bollworms. It is pointed out that the destruction of all bolls in the autumn that are infested with *P. gossypiella* causes the destruction of large numbers of *Pimpla roborator*, which becomes really numerous about the latter part of November.

Two undetermined Pteromalids are parasitic upon the pink bollworm. The larger is apparently a member of the genus *Pteromalus*; the smaller has the same habit of parasitism as *P. roborator*.

The Braconid, *Chelonella sulcata*, Nees, is believed to live as a larva within the body of the pink bollworm until the latter transforms into the pupal stage; it then completes its growth by feeding upon the pupa. The parasite pupates within the empty pupa of the host. As the ovipositor of *C. sulcata* is quite short it can probably only attack the bollworms after the bolls have ripened and split open. This parasite is, however, well adapted to the seasonal habits of its host.

Another Braconid, *Habrobracon* (*Rhogas*) *kitcheneri*, Dudg. & Gough, has been reared in captivity on the pink bollworm, but has not been found in the field on this host. The Ichneumonid, *Limnerium interruptum*, and a Bethylid may also be parasitic upon *Pectinophora gossypiella*.

Insects that are liable to be confused with the pink bollworm are the Tineid, *Pyroderces simplex*, Wlsm., which is frequently found in autumn and winter in bolls injured by some species of bollworm. The eggs are laid on the damaged ripe bolls and the larvae feed on the injured seeds and fibre. The pupa occurs on the damaged boll, enclosed in a light cocoon of silk, and is smaller than that of *P. gossypiella*. The winter is apparently passed chiefly in the larval stage, the moths appearing in April. These probably oviposit on any damaged bolls that are available. The hollyhock moth, *Crocidosema plebiana*, Zell., does not attack cotton, but might be confused with *P. gossypiella* if found on the same food-plant. Another moth, a Pyralid, *Cryptoblabes gnidiella*, Mill., has also been bred from cotton bolls and might also be mistaken for this pest.

CARTWRIGHT (W.). **Treatment of Cotton in the Field as a Combative Measure against *Gelechia* Attacks. Experiments in 1917.**—*Agric. Jl. Egypt, Cairo*, viii, 1918, pp. 43–53.

Experiments conducted against *Pectinophora gossypiella* during 1917 in continuation and amplification of the work of 1916 [see this *Review*, Ser. A, vi, p. 70] clearly demonstrated the following points:—That reduction of water and complete stoppage after the first week in August increases the yield of cotton, does not damage the fibre and ripens the crop earlier; that topping in addition further increases the yield on well-developed cotton and does not damage the fibre.

No direct evidence as to the effect of the treatment on the actual attacks of *P. gossypiella* was afforded by the experiments.

ADAIR (E. W.). **Preliminary List of Insects associated with Cotton in Egypt.**—*Agric. Jl. Egypt, Cairo*, viii, 1918, pp. 80–88.

Large numbers of insects occur on cotton plants in the field, especially in the squares, some of them feeding on the plant, others being predatory, and others simply sheltering from the heat of the sun or the dampness of the ground. A list, necessarily incomplete, is here given of such insects, together with the parasites of many of them.

VAN DER GOOT (P.). **Aphididae of Ceylon.**—*Spolia Zeylanica, Colombo*, xi, no. 40, June 1918, pp. 70–75, 2 figs. [Received 10th February 1919.]

A list of Aphids collected in Ceylon during 1913–14 includes:—*Macrosiphum rosae*, L., on roses; *Micromyzus nigrum*, v.d.G., on ferns and cinnamon; *Toxoptera aurantii*, Boy., on a wide range of food-plants; *T. minuta*, v.d.G., on one of the Cyperaceae; *Aphis gossypii*, Glov., on *Aristolochia indica*, on a Euphorbiaceous weed, and on *Solanum torvum*, being attended on the last plant by the red ant, *Oecophylla smaragdina*; *A. tavaresi*, Del Guer., on citrus; *A. medicaginis*, Koch, on *Crotalaria striata*; *Longiunguis spathodeae*, v.d.G.,

on shoots of *Panax* sp.; *Brachycaudus helichrysi*, Kalt.; *Greenidea artocarpi*, Westw., on the young shoots of *Artocarpus integrifolia*; *Shivaphis celti*, Das, on leaves of *Celtis cinnamomea*; *Oregma insularis*, v.d.G., on leaves of bamboo (*Dendrocalamus strictus*), the colonies being attended by *Oecophylla smaragdina*; *O. minuta*, v.d.G., on leaves of *Dendrocalamus strictus* attended by small blackish ants (*Cremastogaster*); *Cerataphis lataniae*, Boisd., on the inflorescences of an *Areca* palm.

Macrosiphum minutum, sp. n., on *Vernonia cinerea*, and *Greenideoida ceyloniae*, sp. n., on *Messua ferrea* are described.

SENIOR-WHITE (R.). **A Note on *Lymantria ampla* (Walker).**—*Spolia Zeylanica, Colombo*, xi, no. 40, June 1918, pp. 76–80, 2 figs. [Received 10th February 1919.]

Lymantria ampla occurs throughout India, Burma, and Ceylon, and feeds on a great variety of plants, being found in Ceylon on cacao, geranium, begonia and rose, though the normal food-plant in the Matale district is probably cacao. There appear to be four broods a year, in January, April, June and October.

At present this moth is hardly a pest, except of pot-plants such as geranium and begonia, its attacks on cacao being very slight, probably owing to its being kept in check by a Hymenopterous parasite.

GUNN (D.). **The Bagrada Bug** (*Bagrada hilaris*).—*Union S. Africa Dept. Agric., Pretoria*, Bull. no. 9, 26th June 1918, 16 pp., 3 plates. [Received 13th February 1919.]

Bagrada hilaris has been a pest throughout South Africa for many years. The present paper is the result of studies to elucidate the life-history of the insect and to devise suitable measures for its control. The chief food-plants are Crucifers, especially cabbage, turnip, rape, mustard, radish, etc. Leguminous crops such as beans and peas are attacked to a less degree. Fields of wheat have on more than one occasion suffered severely, and many native plants serve as hosts, as well as some of the wild grasses during the summer months. The bug flourishes only during the dry season; ideal conditions for its rapid development are dry weather with a temperature between 70° and 80° F. in the shade. Heavy rain destroys many nymphs and adults. The eggs of *B. hilaris* are deposited on the lower surfaces of lumps of soil; if exposed to the heat of the sun, they soon perish. The incubation period varies from 8 days in warm weather to 14 days in lower temperatures. The nymphal stage lasts from 50 to 81 days, during which five moults occur. The adults are very active for a time; pairing takes place soon after the adult stage is reached, after which the males soon die. The females oviposit about a week later and live for another 8 to 14 days. There are four generations in a year in Pretoria; records of the life-cycles are given in tables. A parasitic Chalcid was reared from eggs of *B. hilaris* at the end of September, but it is thought that this parasite is not abundant enough during the winter months to exercise much check on its host. The Reduviid, *Harpactor segmentarius*, Germ., is predaceous on the nymphs and adults, but does not occur in large numbers. A soil fungus, *Isaria* sp., causes a number of deaths among the bugs, but, like the predaceous

insects, disappears during the winter months when the bugs are most destructive.

Clean cultivation, a system of crop rotation and the growing of all plants in rows render subsequent treatments more easy and effective. Young cabbage and cauliflower plants should be protected by covering them with cheesecloth until they are planted out, and after becoming established, they should be sprayed with either crude carbolic acid emulsion in the proportion of 1 part to 15 parts water, resin wash or the preparation known as Katakilla. Turnip plants can be sprayed with crude carbolic acid emulsion 1 part to 20 parts water, with tobacco extract (non-arsenical) in the proportion of one part to 16 of water with the addition of 1 lb. soap, with resin wash or with Katakilla. Cruciferous plants should not be sprayed with miscible oils as they are liable to be severely injured. If the soil is kept in a moist condition and the lumps broken up oviposition is to a large extent checked. All cabbage stumps and remains of cruciferous plants should be collected and destroyed. Fowls, when allowed to run in infested fields, greatly assist in destroying the insect.

LOUNSBURY (C. P.). **European Foul Brood.**—*Union S. Africa Dept. Agric., Pretoria*, Bull. no. 10, 26th August 1918, 20 pp., 7 figs. [Received 6th February 1919.]

European foul brood was found to exist in certain districts of the Union of South Africa in 1917, the disease apparently being of some years' standing. The present bulletin has been compiled to acquaint the South African public with the nature of this disease in bees and to explain the methods for its control.

GUNN (D.). **The White-lined Grape-vine Sphinx Moth** (*Hippotion celerio*).—*Union of S. Africa Dept. Agric., Pretoria*, Bull. no. 11, 17th September 1918, 6 pp., 4 figs. [Received 6th February 1919.]

The principal food-plant of *Hippotion celerio* is the cultivated grape-vine, especially those varieties with tender foliage, though it has been found feeding upon the foliage of *Acacia caffra* and *A. karroo*, these being, undoubtedly, two of its native food-plants. It also attacks tobacco and sweet potato foliage, as well as that of *Ampelopsis veitchi* and *A. quinquefolia*.

The eggs are deposited singly, either on the upper or lower surface of a leaf, never more than 3 being found on a single leaf. The incubation period lasts for from 6 to 9 days, and after a larval period of about 5 weeks pupation takes place just below the surface of the ground. The pupal period varies from 19 days to more than 6 months in the case of the over-wintering generation. The adults of the first generation usually emerge in the spring and there are 4 annual generations.

No parasitic enemies have been reared and the only insect observed to prey on the caterpillars is a large green Mantid, *Sphodromantis gastrica*. Control is best effected by hand-picking or by spraying the vines as soon as injury is noticed with lead arsenate in the form of paste, 3 lb., or powder 1½lb. to 50 gals. water. When injury to the same vines has occurred in successive years the soil should be cultivated during the winter months to destroy the pupae.

ILLINGWORTH (J. F.). **The Sugar Industry.**—*Queensland Agric. Jl., Brisbane,* x, no. 5, November 1918, pp. 220–221. [Received 4th February 1919.]

The Tachinid parasite, *Ceromasia sphenophori*, has been successfully reared and liberated in fields infested with the sugar-cane borer [*Rhabdocnemis obscura*] and it is hoped that a considerable measure of control will be effected by this means. Attention is drawn to the value of the barn owl in destroying these weevils and also cane rats. Some localities have been much troubled with *Cirphis unipuncta* (army worm) and *Phragmatiphila truncata* (Noctuid moth borer); both of these are freely attacked by parasites, and are thus prevented from becoming serious pests. The caterpillars of *P. truncata* feed inside the shoot, the central leaves usually being entirely killed. The result is that the cane shoots freely at the eyes owing to injury to the terminal bud. The cultivation of a green crop of beans or peas before re-planting with sugar-cane is suggested against these moths.

"Flying-Beetles" attacking Pear-trees.—*New Zealand Jl. Agric., Wellington,* xvii, no. 5, 20th November 1918, p. 315. [Received 13th February 1919.]

In answer to a correspondent, who reported that winged beetles had practically defoliated young pear-trees during October, it is stated that two species are concerned. *Odontria zealandica*, known as the brown beetle, is the adult of the well-known grass-grub. It flies only by night and can be shaken off the tree on to a sheet of canvas. *Eucolaspis brunnea* (bronze beetle) flies by day and can be caught in the same manner. Lead arsenate is effective against both species if used strong enough, more than one application being necessary.

The Weevil Pest of Grain. Summary of Proceedings of Conference held in Melbourne, October 15th 1918.—*Jl. Dept. Agric. Victoria, Melbourne,* xvi, no. 11, November 1918, pp. 695–700. [Received 4th February 1919.]

A conference held in Melbourne has discussed the investigations carried out by the South Australian Weevil Committee, which was appointed about a year previously to deal with the question of the serious losses occasioned by the depredations of the wheat weevil [*Calandra granaria*] in stored wheat. The first experiments carried out were to determine the possibility of poisoning by means of gases. Hydrocyanic acid, carbon bisulphide, carbon monoxide, and carbon dioxide were tried; carbon bisulphide was probably the most efficient, though it was found later that the weevil could be asphyxiated by the use of carbon dioxide. Treatment with lime was found ineffective. Storage in sand was satisfactory on a small scale, but not so suitable for large quantities. Treatment by means of heat was tried and seemed promising. It was considered that most heating machines work at too high an initial temperature and the pressure of steam is too great. A machine constructed in South Australia works at atmospheric pressure. It was realised, however, that heat is not a solution of the whole difficulty, as it is impossible to treat all the affected wheat in time. Experiments in sealing up weevil-infested wheat in

bottles showed that the weevils died in a fortnight. A tube that had been sealed for 5 days showed a content of 15 per cent. carbon dioxide and this was sufficient to kill the weevils. These experiments indicate the possibility of enclosing stacks with a covering of malthoid, making them as airtight as possible and then pumping in carbon dioxide. An experiment on these lines was carried out with 8,500 bags of heavily infested wheat. Inside the malthoid 10 to 15 per cent. of carbon dioxide was maintained continuously. Gas was generated by passing air over a bed of hot coke in a furnace, with the object of obtaining a mixture containing as nearly as possible 80 per cent. nitrogen and 20 per cent. carbon dioxide with no free oxygen. The purpose was to displace all the oxygen and thus render the oxygen content too low to support life. The experiment was highly successful, no living weevils being found in the stack though there were millions of dead ones. It is evident that weevils can be destroyed by this means without handling the wheat. Though it is impossible to make the malthoid enclosure absolutely air-tight, the continuous passing in of nitrogen and carbon dioxide enables the asphyxiating atmosphere to be maintained. Larvae and pupae as well as adults were destroyed by this process, but it is not yet known whether the eggs can survive it. It was pointed out that a malthoid covering is an absolute protection, neither insects nor mice being able to penetrate it. With regard to the salt-water treatment that has been recommended for old bags, etc., on the seaboard, it has been found that the weevils can live for nine days in sea-water and can also survive five hours in methylated spirit.

The meeting expressed satisfaction with the work carried out by the South Australian Weevil Committee and recommended that the investigations should be continued. These should deal with the examination of insect-infested grain from all parts of the Commonwealth; investigations into the life-history of the insects causing the damage, and a study of such factors as temperature, moisture and aeration; an estimation of the water content of such wheat in various conditions; recording of the changes in the water content during maturation and dormancy af the grain and co-ordination of these changes with atmospheric conditions and experiments on the degree and rate of absorption of water in atmospheres artificially charged with moisture. The South Australian Committee should also continue their experiments on the effect of hermetically sealing wheat and its influence on vitality, with investigations on heat treatment and its effects on the vitality of wheat and its keeping and milling properties. It was also suggested that the effect of lime should be further investigated.

BRITTAIN (W. H.). **Practical Results in Spraying a Commercial Orchard for the Green Apple Bug.**—*Canadian Entomologist, London, Ont.*, l, no. 12, December 1918, pp. 393–397.

Operations demonstrating the control of the Capsid, *Lygus communis* var. *novascotiensis*, Knight (green apple bug), in an apple orchard taken over for that purpose during 1917, prove the advantage of prompt and thorough spraying for this pest as soon as infestation is observed, the benefit being evident even when only a single year

is considered, although the results should be taken into account over a period of years. The orchard tested was an old one where infestation was rendering the trees worthless. In most cases the trees bloomed heavily, but the blossoms were generally injured before the fruit was formed, or, if it set, it was punctured by the bug until it fell or became deformed. The damage to the smaller twigs was also very apparent, while much of the young growth had been killed outright. Younger trees of mixed varieties in another part of the orchard were also being attacked when the entire orchard was sprayed with 1 pint Blackleaf 40 to 100 gals. In the spray immediately before the blossoms opened, this was combined with lime-sulphur and calcium arsenate. In the after-blossom spray, the fungicide was sodium sulphide and the arsenical poison was omitted. Although there was some delay in spraying the older trees, a fair measure of control was obtained, while in the younger trees where the spray was promptly applied the bugs were practically eliminated. Compared with the yield that might have been expected from previous years' production and with the crop for the entire valley, the theoretical crop from the demonstration orchard should have been 393 barrels, but in point of fact it was actually 1,469 barrels. Tables show a comparison between the crop of the experimental orchard and that of the neighbouring valley and the percentage of different grades of all varieties both in the valley and in the experimental orchard. In 1918, the experimental orchard was not sprayed for the bug. Examination showed that in the older and larger trees there was still considerable infestation, though not as severe as formerly; while in the younger trees, where the best spraying had been done, the pest could only be found by searching for it. The value of thorough and timely work for the future year's crop is thus further emphasised.

NICOLAY (A. S.) & WEISS (H. B.). **Notes on *Chalepus rubra*, Web., in New Jersey.**—*Canadian Entomologist, London, Ont.*, l, no. 12, December 1918, pp. 398–400, 1 plate.

The Hispid, *Chalepus rubra*, Web., has been previously recorded as attacking locust, basswood, oak and soft maple, while the larvae have been known to mine the leaves of white oak, apple and linden. Additional food-plants recorded for the adult beetles are white birch, hornbeam, cherry, juneberry and *Pyrus arbutifolia*, as well as apple, choke-cherry and shadbush. In New Jersey the mines are found in the leaves of various species of oak, all the parenchyma being eaten and showing a white elongate discoloration, generally at the edge of the leaf. During late June and early July the larva can easily be found in the mines. The pupal stage occurs during the last week in July and early August, the beetles emerging during the second week of August and later. The full-grown larva and pupa are described.

WEISS (H. B.) & DICKERSON (E. L.). **The Life-history and Early Stages of *Corythucha parshleyi*, Gibson.**—*Canadian Entomologist, London, Ont.* l, no. 12, December 1918, pp. 401–406.

The Tingid, *Corythuca parshleyi*, Gibson, was originally described as feeding upon walnut and juneberry (*Amelanchier intermedia*), but repeated visits to the type locality in New Jersey and numerous

examinations have led to the conclusion that it is found only on walnuts. In New Jersey this species has been found on butternut (*Juglans cinerea*, walnut (*J. nigra*) and Japanese walnut (*J. sibboldiana*), while outside New Jersey it has been taken on pecan. In southern New Jersey adults that have hibernated appear about the middle of May, and oviposition occurs during the third and fourth weeks, from 1 to 4 eggs being laid in the angles formed by the mid-rib and the side ribs on the under-surface of the leaf. Most of the eggs are placed in the basal half of the leaf and none at the tips where the veins are finer. By the third week in June a few second-stage nymphs and many of the third and fourth and a few fifth-stage ones were found. By the end of the first week in July adults of the first generation were present with many fifth-stage nymphs. Eggs were deposited soon afterwards, and during the last week in July first-stage nymphs of a second generation were observed. During late August and early September adults of the second generation appeared and later went into hibernation. There are therefore two generations, each requiring about six weeks. On account of the extended oviposition period, all nymphal stages may be found at the same time as adults. The nymphs feed in colonies on the under-surface of the leaves, causing a discoloration of the upper surface. In severe infestations the leaves become yellow and dry and many fall to the ground. All stages of the insect are described. *C. juglandis*, Fitch, which resembles and is frequently confused with *C. parshleyi*, occurs throughout New England and south and west to Kansas and Texas, its food-plants including walnut, butternut and lime. It undoubtedly occurs in New Jersey, though up to the present time no species but *C. parshleyi* has been found there on walnut.

Ross (W. A.). **The Pear Psylla.**—*Canadian Horticulturist & Beekeeper, Toronto*, xxvii, no. 1, January 1919, pp. 3–4.

Weather is an important factor in control of the pear psylla [*Psylla pyricola*]; a protracted period of cold and wet in the spring destroys many eggs and newly hatched young, while long periods of hot, dry weather are fatal to numbers of nymphs. Experience in spraying in Ontario has shown that the most economical and satisfactory method of combating this pest is to postpone the dormant application of lime-sulphur until shortly before the trees bloom and then thoroughly drench all parts of the trees, including the under-side of the twigs and branches. This destroys the newly-hatched nymphs and mature eggs. To the spray applied just after the blossoms fall nicotine sulphate 40 per cent. should be added at the rate of ¾ pint to 80 gals. of spray mixture; this kills the nymphs in the axils of the leaf-petioles and blossom-stems.

Treherne (R. C.). **Insect Notes of the Year 1918.**—*Agric. Jl., Dept. Agric., Victoria, B.C.*, iii, nos. 11–12, January-February 1919, pp. 258, 281 & 301.

Observations on *Taeniothrips inconsequens* (pear thrips) continued during recent years have shown the dates of emergence of the adults to be from the last days of March until the end of April. It has been found that spraying against the adults is more important than

against the larvae, and applications of nicotine and soap spray were therefore made on 3rd, 10th and 22nd of April, the pears beginning to bloom on 22nd April. The number of applications given previous to blossoming depends on the degree of infestation.

The results of investigations into the life-history of *Anarsia lineatella* (peach worm), which are given in detail, show that there are two generations of this moth in a year, adults appearing and laying eggs between 29th May and 19th June and again between 26th August and 15th September. Fruit-growers are recommended to spray in the week previous to blossoming with lime-sulphur 1: 9, followed by a lead arsenate, spray after blossoming. It is suggested, however, that a combination of these two sprays (lime-sulphur 1 : 9, plus 2 lb. lead arsenate, to 40 gals.), applied just previous to blossoming, would probably prove both efficacious and more economical. This should be applied to the tips of the trees with good pressure and into the crotches of the finer branches.

Otiorrhynchus ovatus (strawberry-root weevil) continues to be a destructive pest [see this *Review*, Ser. A, v, p. 469]. Other strawberry pests in British Columbia are *Aegeria* (*Synanthedon*) *rutilans* (crown moth), *Aristotelia* sp. (crown-borer), *Polyphylla decemlineata* (white grub), Tipulids and wireworms. The life-histories and habits of these are being studied; the control suggested in the present state of knowledge is the rotation of strawberries with other crops at short intervals.

Wireworms have been responsible for considerable damage to onions, maize and potatoes. Baits were made by moulding baked rice, shorts and water into small balls which were set in the soil 2 or 3 inches deep in rows 10 by 5 feet. Various poisons were added to the baits without any apparent influence on the results. After a week or ten days the baits were removed from the soil, broken open and the wireworms removed by hand. The balls were then remoulded and re-set in the soil for another ten days. Two applications were considered sufficient for the year, and from 6,707 baits, 25,939 wireworms were collected. This method is tedious, but would undoubtedly gradually clear the land of wireworms. Sliced potatoes can similarly be used as baits.

For *Hylemyia antiqua* (onion maggot) the new poison-bait of sodium arsenite and molasses was tried, but did not give much success. It is hoped by next year to have discovered the proper times for application; it is thought that May and July should be the time for setting baits. *Thrips tabaci* (onion thrips) caused considerable trouble in onion-growing districts. Soap and nicotine sprays should be applied as soon as thrips appear in numbers in the axils of the leaves; in 1918 this was about 20th June. Later applications are dependent upon weather conditions; in moist weather thrips do not multiply rapidly. Cutworms (*Euxoa messoria*) were plentiful and preparations against them should be made in the winter. Poison-baits should be worked into the soil before the crop is planted in the spring or after the crops are above ground. In spraying for *Eriosoma lanigerum* (woolly aphis) it was found that a pressure of at least 225 lb. was necessary. *Psylla pyricola* (pear psylla) has been recorded in British Columbia, although no damage is as yet attributed to it. Other pests newly reported in British Columbia are *Bruchophagus funebris* (alfalfa seed Chalcid),

which in some localities causes 50 per cent. of infestation in lucerne, and *Meromyza americana* (greater wheat-stem maggot). It is believed that two or three generations of this fly occur in a season and that autumn wheat is more seriously injured than the plants attacked by the earlier generation in June and July.

Rhagoletis pomonella (apple maggot) has been taken in considerable numbers breeding in native snowberry (*Symphoricarpus racemosa*) and probably occurs wherever this plant exists in British Columbia, but has not been taken on apple. *Cydia pomonella* (codling moth), while showing a general reduction in most localities, has broken out in certain fresh orchards; strenuous action will be necessary in 1919 to counteract this spread.

KNIGHT (H. H.). **An Investigation of the Scarring of Fruit caused by Apple Redbugs.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. no. 396, February 1918, pp. 187–208, 37 figs. [Received 10th February 1919.]

The injuries produced in apples by the bug, *Lygidea mendax*, depend largely on the kind of apple, some varieties being more subject to fatal injury than others, and also on the age of the fruit when the puncture is made. If the core of the young apple is punctured, a deep pit results in the mature fruit, but punctures made after the fruit is ¼ inch in diameter result in the formation of broad russet scars. The healing of wounds made after the middle of July and usually produced by the tussock moth [*Hemerocampa*] or the plum curculio [*Conotrachelus nenuphar*] depends largely on the variety of apple. The nymphs of *L. mendax* begin hatching just as the blossom-buds begin to open and most of them have entered the fourth stage by the time the petals have fallen, it being during the fourth and fifth instars that the maximum damage is done. The adults, practically all of which have appeared by 22nd June, feed on the fruits extensively for a week or more, and then begin feeding on the tender developing shoots. Injuries inflicted at this stage may resemble the work of apple maggot flies [*Rhagoletis pomonella*] or of *Syntomaspis druparum* (apple-seed Chalcid), but in the latter case the larvae are to be found in the seeds. Under certain conditions *Aphis sorbi* (rosy aphis) may develop and feed on apples injured by red-bugs, with the result that the fruit is stunted and badly misshapen.

Heterocordylus malinus (dark apple red-bug) develops 7–10 days earlier than *L. mendax*, the nymphs hatching with the unfolding of the leaves and feeding on the tender foliage and to a slight extent on the fruit before reaching maturity, which occurs together with oviposition by the time the fruit is large enough to be injured. In western New York the work of *H. malinus* in producing knotty fruit is very limited or entirely absent on the standard varieties of apples.

Conotrachelus nenuphar (plum curculio) on emergence from hibernation is a voracious feeder and attacks young apples as soon as they are formed, these early-formed punctures not being usually accompanied by egg-laying. Later punctures together with oviposition result in the formation of a characteristic crescent-shaped scar.

Lime-sulphur spray, if the young fruit is drenched, will cause slight burning and the injury may result in russet scars resembling in some

respects the work of red-bugs. The peculiar festering noted in the wounds made by feeding red-bugs and their subsequent development are so characteristic that it seems very probable that some secretion of the insects is an important causative factor.

Spraying begun on 30th April, when the buds were just showing pink, with the usual lead arsenate and lime-sulphur 1 to 40, to which had been added 1 quart Blackleaf 40 to each 200 gal. tank, resulted in the nymphs being killed with ease, direct contact with the spray not being necessary since they were overcome by the fumes. A similar spray in which the Blackleaf 40 was reduced to $\frac{3}{4}$ quart was equally effective if the spraying was thoroughly done. No further application was necessary, and it is evident that where the pest is thoroughly eliminated by spraying further remedial measures will not be needed for at least three years.

HAWLEY (I. M.). **Insects Injurious to the Hop in New York, with Special Reference to the Hop Grub and the Hop Redbug.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Memoir 15, November 1918, pp. 147–224, 60 figs. [Received 10th February 1919.]

The Noctuid, *Gortyna immanis*, Gn. (hop borer), is a native North American insect and is especially abundant in the Eastern States and in Canada where hops are grown, being able, so far as is known, to reach maturity only on that plant, though young larvae have been found attacking maize and grass. Newly hatched larvae may crawl long distances and enter any part of the plant that is tender enough for them to break through, the bud-like tip of the head of the hop forming a place for easy entrance. Injury results in the killing of the growing point and consequent stunted growth of the head, the damage however being relatively small. Most of the larvae, after working in the tip for 1 or 2 weeks, drop to the ground and join those attacking the vines.

Most of the eggs, which are laid on grass, hatch at a time when the vines are short and tender and the young larvae usually enter the stem near the surface of the ground and burrow in the pithy centre until further growth necessitates their eating their way out of the stem. After leaving it, the caterpillar either eats its way into a bed-root, or feeds on the outside of the vine between the bed-root and the surface of the ground. The resulting injuries prevent the return flow of sap to the roots, which become weakened and readily succumb to winter frosts. Many caterpillars are already external feeders or in the bed-root by the end of the first week in June, damage inside the vines being completed by the end of the second week, though that in the roots continues from the middle of July to the middle of August. In July or the first part of August the larva pupates, and the moth emerges at the end of August or early in September, depositing eggs that hibernate on grass and hatch from the last week in April to the last of May. The egg-stage occupies about 8 months, the larval 9–12 weeks, and the pupal 4–6 weeks.

An important natural predatory enemy of the larvae, and probably of the pupae, is the skunk, which does not, however, reduce the injury of the year, for by the time it becomes active the larvae are full-grown and the damage is done. Both the larva and the adult of the Carabid

beetle, *Calosoma calidum*, F., are active in attacking the larvae of *G. immanis*, while other Carabids known to be predaceous on them are :—*Harpalus pennsylvanicus*, Dej., *Pterostichus lucublandus*, Say, *P. stygicus*, Say, and *Amara impuncticollis*, Say. The Braconid, *Microplitis gortynae*, Riley, is a common parasite of the larva of *G. immanis*. Other parasites are *Aenoplex* sp., a Chalcid, *Synaldis* sp., and the Tachinids, *Frontina frenchi*, Will., and *Masicera myoidea*, Des.

Cultural methods of control consist in removing all extra vines before 1st June to some distance from the yard ; hilling the hops, so as to give the extra rootlets an opportunity to grow ; practising clean cultivation by removing all grass ; keeping a ploughed border several yards wide round the field ; using para-dichlorobenzene as an insecticide by placing a few crystals in each hill and covering with about two inches of soil, the application to be made about the third week in May.

The new pest of the hop vine, *Paracalocoris hawleyi*, Knight, has already been dealt with [see this *Review*, Ser. A, vi, p. 109].

An old, but little known pest, *Hypena humuli*, Harr. (hop snout-moth), is widely distributed, occurring in most parts of the United States and southern Canada and feeding, so far as is known, only on the hop. The eggs of the first brood are deposited among the hairs on the under-side of the leaf during May, when the hops are only a few feet above ground. These eggs, which are laid by overwintering females, may not hatch for 3 weeks, but the exact length of the egg-stage is unknown. Eggs of the second brood are also deposited on leaves, having been found from 28th July to 11th August. The larvae, which are full grown by 1st July, eat out a clean-cut hole either on the margin or in the central part of the leaf, the larval stage lasting about one month. The pupal stage covers about 13 days, the pupae having been found on the surface or just beneath the upper layer of soil, or on hop-poles or dead vines. Adults emerge about the middle of July, eggs of the second brood being laid in from 1 to 2 weeks and hatching in the first week in August. The second-brood larvae pupate early in September, the hibernating adults issuing during the latter half of September.

Predaceous natural enemies of the caterpillars of *H. humuli* are the nymphs of *Paracalocoris hawleyi* and adults of *Reduviolus subcoleoptratus*, Kirby. Parasites include the Tachinids, *Masicera rutila*, Meig., *M. eufitchiae*, Towns., and *Exorista hypenae*. If spraying is practised for the hop aphis (*Phorodon humuli*), the addition of lead arsenate to the nicotine sulphate spray should prove a satisfactory remedial measure against this moth, and it has been reported that powdered lead arsenate mixed with the sulphur used for the hop mildew, in a ratio of 1 to 10, has been found effective.

The Geometrid, *Nematocampa limbata*, How., a new leaf-eating pest of the hop, has been found in large numbers in one locality in New York State. It is a general feeder, having been reported from currant, birch, stonecrop, plum, apple, oak, hazel and strawberry. The eggs, which are laid on hop-poles in the latter part of August, hatch at the end of the following June. The pupal stage, lasting two weeks, is entered at the end of July and the adults appear about the middle of August, beginning to oviposit in about a week. There is one

generation a year. It should be possible to control the pest by dusting with powdered lead arsenate and sulphur in the ratio of 1 to 10.

Phorodon humuli, Schrank (hop aphis) in the eastern United States has been found to winter only in the egg-stage on plum. On the hop the winged forms are found on the under-side of the topmost leaves, the wingless descendants from these also living on the underside of the tender foliage. When the young hops are formed the Aphids migrate to them in large numbers. Two species of ants have been found associated with *P. humuli*, viz.:—*Formica fusca* var. *subsericea*, Say, and *Prenolepis imparis*, Say. Injury to the hop consists in the weakening of the vines and the stunting of the hop cones, and in the attack of a fungus (*Cladosporium*) in the honeydew coating the plant.

Predatory natural enemies include the Coccinellids, *Adalia bipunctata*, L., *Hippodamia convergens*, Guér., *H. parenthesis*, Say, *Coccinella trifasciata*, L., *C. novemnotata*, Hbst., *C. sanguinea*, L., and *Anatis quinquedecimpunctata*, Oliv.; the Syrphids, *Allograpta obliqua*, Say, and *Syrphus americanus*, Wied.; and *Chrysopa oculata*, Say, and *Hemerobius stigmaterus*, Fitch. One Braconid parasite, *Praon* sp., has been bred from the hop aphis.

The control recommended for this Aphid consists in spraying in the last week of June or the first in July with nicotine sulphate (1–2,000, or ⅜ pint to 100 gals.) and soap (4–100). The soap should be melted in quantity, a large iron kettle being convenient for this purpose.

Tetranychus telarius, L., has occasionally appeared on hops in New York, but has never caused serious damage, and in view of the short growing season and the cold winters it is not likely to become a serious pest.

The butterflies, *Polygonia interrogationis*, F., and *P. comma*, Harris, are not of economic importance, only slightly injuring the leaves, and they are held in check by a Chalcid, *Pteromalus vanessae*, Harris. Other minor insect pests of the hop are *Empoasca flavescens*, F., and *E. flavescens birdi*, Goding (leaf-hoppers); *Agromyza* sp. (leaf-miner); *Psylliodes punctulata*, Melsh., and other flea-beetles; *Tortrix* (*Archips*) *rosaceana*, Harr., and *T.* (*A.*) *argyrospila*, Wlk. (leaf-rollers).

Dudley (F. H.). **Report of State Horticulturist. Insects and Diseases of Fruit and Tree.**—*16th Ann. Rept. Commissioner Agric. State of Maine, 1917*; *Waterville*, 1918, pp. 45–54, 1 plate, 5 figs. [Received 10th February 1919.]

Tortrix (*Cacoecia*) *cerasivorana* (cherry-tree ugly-nest Tortricid) is a very destructive pest that occurs from the 1st to 15th July upon choke-cherry and sometimes upon cultivated cherry. The larvae fasten together all the leaves and twigs of a branch and feed upon them, an entire brood occupying a single nest, within which they pupate. All nests should be cut and burnt, and all foliage sprayed with lead arsenate paste, 2 to 3 lb. to 40 U.S. gals. water. The young larvae of *Pissodes strobi* (white-pine weevil) bore into the tender tops of the trees and eat downwards, rendering it necessary to cut away and burn the infested part. The apple curculio [*Anthonomus quadrigibbus*]. which hibernates in the adult stage, punctures the young apple and feeds on the pulp, causing great injury and deformity of the fruit. To control this pest 2 or 3 applications of lead arsenate

are necessary, the first being the codling-moth spray, and a second, 6 or 10 days later, the latter being the most important. The third spray should be applied 2 weeks later if the injury in former years has been great, *Enarmonia prunivora* (lesser apple worm) damages apples by eating out a small hole at the calyx end. Scurfy scale [*Chionaspis furfura*] affecting mountain ash, flowering quince, apple and pear trees may be exterminated by the use of a dormant spray of lime-sulphur, 1 part to 10 parts of water.

A spray calendar for apple trees concludes this paper.

PHILBROOK (E. E.). **Report of Special-Field Agent, Gypsy Moth Work.**—*16th Ann. Rept. Commissioner Agric. State of Maine, 1917; Waterville*. 1918, pp. 57–61, 3 plates. [Received 10th February 1919.]

The collection and destruction of the egg-clusters of the gipsy moth [*Porthetria dispar*] was begun on 1st April, and continued till the eggs hatched, 1,675,780 egg-clusters being destroyed, and 500 gals. creosote being used in painting the clusters. Spraying was then begun and continued till the middle of August with excellent results, 6 tons of lead arsenate being used. As soon as the brown-tail moth [*Nygmia phaeorrhoea*] had pupated, the application of bands of burlap was begun, 97,000 trees being treated, resulting in the destruction of 988,000 caterpillars. Winter scouting was begun on 10th October, to be continued until the eggs hatch in the spring.

Infestation by the brown-tail moth is less severe than has been the case for several years, there having been a great reduction of winter webs, and if natural enemies continue their effective control, the insect should be held in check with small expense. The area at present infested amounts to 16,708 square miles.

The gipsy moth infestations have been reduced during the past year, though the infested territory, extending to 7,614 square miles, remains about the same.

BRITTAIN (W. H.) & SAUNDERS (L. G.). *Empoasca unicolor* **as an Apple Pest.**—*Proc. Entom. Soc. Nova Scotia for 1917, Truro*, no. 3, January 1918, pp. 69–73, 1 plate. [Received 11th February 1919.]

Empoa rosae, L. was abundant upon apple foliage in 1915 and 1916. This proved to be the most common leaf-hopper infesting apples in Nova Scotia, and accompanying it, though generally in smaller numbers, was another species, *Empoasca unicolor*, Gill. The resultant mottling of the leaves is very similar for the two species. A description of all stages of the latter insect is given. The eggs of *E. rosae* begin to hatch soon after growth starts in the spring, but these have already developed to the 4th and 5th instar before the nymphs of *Empoasca unicolor* begin to appear. The nymphal stage apparently lasts about six weeks; adults then appear and, after pairing, eggs are laid beneath the bark of the twigs. There is only one generation in a season. Details of the life-history are shown in a table. If the insect is present in such numbers as to require special treatment, a spray of nicotine sulphate or fish-oil soap should be used; it was also noticed that a finely powdered tobacco dust destroyed numbers of the nymphs.

BRITTAIN (W. H.). **The Tree Hoppers of Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1917, Truro,* no. 3, January 1918, pp. 7–14, 6 plates. [Received 11th February 1919.]

This popular article is intended to be one of a series of similar papers on the insects of Nova Scotia. Short notes on the classification and food-habits of the insects are given, with a life-history of one species, *Publilia concava,* Say, which does not appear to have been previously recorded.

BRITTAIN (W. H.). **Notes on the Yellow Leaf Hopper of Birch.** (*Oncopsis sobrius,* **Walk.**).—*Proc. Entom. Soc. Nova Scotia for 1917, Truro,* no. 3, January 1918, pp. 18–20, 1 plate. [Received 11th February 1919.]

Oncopsis sobrius, Wlk. (yellow leaf-hopper) is frequently found on birches in the vicinity of Truro and elsewhere in Nova Scotia, though less abundantly than the related species, *O. fitchi,* Van D. There is apparently only one generation in a year. A table shows the life-history of individuals reared in the laboratory, and a description of the various stages is given.

BRITTAIN (W. H.). **Miscellaneous Notes on the Apple Maggot** (*Rhagoletis pomonella,* **Walsh**).—*Proc. Entom. Soc. Nova Scotia for 1917, Truro,* no. 3, January 1918, pp. 37–41. [Received 11th February 1919.]

A table gives the record of emergence of adults of *Rhagoletis pomonella* in 1917 from out-door cages. It was observed that 30 per cent. of the entire emergence took place in the second year, a habit that would enable the insect to live through a total failure of its food-plants for one year. Oviposition may take place in as short a time as four days after emergence. The percentage of fertility of the eggs varies greatly with the variety of the host, and the season. The tests of the previous year regarding the effect of chemicals upon the pupae [see this *Review,* Ser. A, iv, p. 370, and v, p. 269] were completed, and confirmed the opinion that this method of dealing with the pest is unsatisfactory.

PAYNE (H. G.). **The Zebra Caterpillar** (*Ceramica picta,* **Harris**). **The Fall Canker Worm** (*Alsophila pometaria,* **Harris**). **The Rusty Tussock Moth** (*Notolophus antiqua,* **L.**). **The White Marked Tussock Moth** (*Hemerocampa leucostigma,* **A. & S.**)—Proc. Entom. Soc. *Nova Scotia for 1917, Truro,* no, 3, January 1918, pp. 44–67, 4 plates. [Received 11th February 1919.]

An account is given of each of these well-known pests, with notes on the life-histories accompanied by tables. *Ceramica picta* (zebra caterpillar) is a general feeder and attacks many vegetables and cultivated flowers. The chief damage is done by the second generation late in the season. Dipterous and Hymenopterous parasites were reared during this investigation, but are as yet undetermined.

Alsophila pometaria (fall canker-worm) has severely infested orchards in the Annapolis Valley during the past three years In addition to orchards, almost any deciduous tree may be attacked ; large areas

of oak (*Quercus alba*) have been completely defoliated, Rosaceous plants and grasses, as well as elm, beech, maple and hawthorn, were also severely injured.

Orgyia (*Notolophus*) *antiqua* (vapourer moth) will feed upon the foliage of almost any kind of tree with no apparent difference in feeding habits. Pupal parasites include *Scambus inquisitoriellus*, D. T., and *S. indagatrix*, Walsh; the only larval parasite found was *Cratotechus orgyiae*, Fitch. The Pentatomids, *Podisus serieventris*, Uhler, and *P. maculiventris*, Uhler, are predaceous on the larvae.

Hemerocampa leucostigma (white-marked tussock moth) is a general feeder on the foliage of deciduous trees, and when present in large numbers has been known to feed extensively on coniferous trees such as spruce, fir and pine. Frequently after the 2nd or 3rd instar the larvae cease to feed on foliage and attack young apples. Pupal parasites were the same as those of *O. antiqua* and also included *Tachina mella*, Walk., and *Rhogas intermedius*, Cress.(?).

McLaine (L. S.). **The Introduction of the Parasites of the Brown-tail and Gipsy Moths into Canada.**—*Proc. Entom. Soc. Nova Scotia for 1917, Truro*, no. 3, January 1918, pp. 74–76, 1 plate. [Received 11th February 1919.]

The introduction and history of the brown-tail moth [*Nygmia phaeorrhoea*] and of the gipsy moth [*Porthetria dispar*] in the United States are briefly reviewed. In consequence of the appearance of the former in New Brunswick and Nova Scotia and of the close proximity of the latter to the Canadian boundary, it was decided to introduce insects that are parasitic upon these species and also, to ensure their establishment, upon native insects. The parasites chosen were a Braconid, *Apanteles lacteicolor*, Vier., a Tachinid, *Compsilura concinnata*, Meig., and a predaceous beetle, *Calosoma sycophanta*, L. The method of colonisation and the action of these parasites on their hosts is described.

Sanders (G. E.) & Kelsall (A.). **The Dropping of Apples caused by Spraying with Lime-Sulphur.**—*Proc. Entom. Soc. Nova Scotia for 1917, Truro*, no. 3, January 1918, pp. 77–84. [Received 11th February 1919.]

Complaints were received from apple-growers in the Annapolis Valley during 1913 and 1914 that spraying with lime-sulphur had caused the apples to drop. A thorough investigation into this question and many experiments, some of which are given in detail, have led to the following conclusions. It is the lime-sulphur that is applied to the under-side of the leaf that causes the damage. The least injury is caused by the early sprays, the damage increasing with each successive application. Lime-sulphur of 1·005 sp. gr. will do more damage, when wrongly applied, than that of 1·01 sp. gr. properly applied. Some varieties of apple are more easily injured than others. The amount of sunlight, which affects the chlorophyll content of the leaves, determines to a great extent the amount of lime-sulphur injury. Upon the humidity of the atmosphere depends the rapidity with which the solution dries on the trees, and the longer the spray is on the leaves, the greater is the injury. A heavily loaded tree will not stand as

much, or as strong spray, as one that is not full of fruit. The state of the solution at the time of use has also been found to have some influence on the amount of injury [see this *Review*, Ser. A, i, p. 455]. From this evidence it is deduced that the question of lime-sulphur injury is an extremely local problem; it is hoped that it may be possible in a year or two to determine from meteorological records, from a knowledge of the varieties grown and from the methods followed in any locality, whether and what to extent lime-sulphur can safely be used.

BRITTAIN (W. H.) & SAUNDERS (L. G.). **Notes on the Biology of *Lygus pratensis*, L., in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1917, Truro*, no. 3, January 1918, pp. 85–91. [Received 11th February 1919.]

During 1917 a study of the life-history and habits of *Lygus pratensis* (tarnished plant bug) in Nova Scotia was undertaken. Adults issuing from their winter quarters were found resting upon apple and pear buds in orchards on bright sunny days, but no harm has been observed as a result of their presence at this time. The favourite food-plant in early spring is sheep sorrel (*Rumex acetosella*); most of the hibernated adults oviposited in the flower-stems and leaf-petioles of this plant and perished by the first week in July, when those of the first spring generation began to appear. After three weeks all nymphs had reached the adult stage and sorrel was abandoned. The eggs of this generation are laid in the petioles and midribs of beets and mangels, the incubation period being 9 to 11 days. A description of the stages is given, and Knight's description of the adults of the two forms found in Nova Scotia, namely, *Lygus pratensis* var. *oblineatus*, Say, and *L. pratensis* var. *rubidus*, Knight, is quoted. The leaves of beets and mangels are seriously injured by the adults' feeding-punctures, the outer leaves being wilted and curled, while those at the centre grow up very thick and curled. Besides this injury, young flower blossoms of dahlias, peonies, asters and other garden plants are spoiled and distorted. Nymphs of the second brood appear about 6th August; there are five nymphal instars lasting altogether 36 to 39 days. Adults of this generation appear about 28th August, and continue until the frosts begin, when many of them perish. The insect is considered to be one of the most injurious pests in Nova Scotia, and the question of its control is an important problem that awaits solution.

BOURNE (A. I.). **Department of Entomology.**—*Thirtieth Ann. Rept. Massachusetts Agric. Expt. Sta., Boston, Mass.*, January 1918, pp. 51a–53a. [Received 11th February 1919.]

Inquiries regarding insect pests were far more numerous than in previous years. Unusually severe outbreaks occurred of several species that normally are not of much economic importance. The rose chafer [*Macrodactylus subspinosus*] was present in large numbers and proved a serious pest to garden crops and young fruit trees. The chrysanthemum gall-fly [*Diarthronomyia hypogaea*] was reported from several places in the State; owing to the enormous expense necessary

to eradicate this pest once it is established. its appearance caused great uneasiness to florists. The potato aphis [*Macrosiphum solanifolii*], which is usually present in small numbers, caused great destruction in some fields. Insect pests reported in the State for the first time included the asparagus miner [*Agromyza simplex*?] and parsnip webworm [*Depressaria heracleana*].

A new pest, *Pyrausta nubilalis*, Hbn. (European corn borer), was found to have become established near Boston [see this *Review*, Ser. A, vi, p. 551].

The Pink Bollworm Situation. Service and Regulatory Announcements, October-November 1918.—*U.S. Dept. Agric., Washington, D.C., Federal Hortic. Board*, no. 57, 7th January 1919.

In view of the fact that the pink bollworm of cotton [*Pectinophora gossypiella*] has apparently been eradicated in Texas owing to the energy and co-operation of planters, a plan has been formulated for permission to plant cotton in 1919 in the non-cotton zones in Texas, other than the border zone, under the joint supervision of the State and Federal Departments of Agriculture. Under this arrangement the planter agrees not to plant any seed originating within a quarantined or non-cotton zone, and to allow the Commissioner of Agriculture or his agent to inspect or supervise the growing of his cotton in the fields, to keep his cotton plants under constant inspection for any sign of infestation, and to gather the cotton crop immediately it matures. If at any time the presence of the pink bollworm is discovered, the Commissioner of Agriculture is to have a free hand in dealing with or destroying the crop. The planter furthermore agrees to use his influence with other planters to conform to this agreement and undertakes to report any infestation of pink bollworm that comes to his notice.

BLACKMORE (E. H.). **Entomology.**—*Rept. Provincial Museum Nat. Hist. Brit. Columbia for Year 1917*; *Victoria*, 1918, pp. 9-15, 2 plates.

A rather severe outbreak of cutworms occurred in the Victoria and Vancouver districts during May and the early part of June, whole beds of garden produce being completely devastated. The chief pests concerned were *Feltia ducens*, Wlk. (dingy cutworm), *Sidemia devastatrix*, Brace (glassy cutworm), and the larvae of *Euxoa messoria*, Grote, *E. excellens*, Grote, and *Feltia vancouverensis*, Grote. The last-named species has not hitherto been regarded as of much economic importance, but it appears to do as much damage as any of the others, with the possible exception of *S. devastatrix*.

During September a particularly bad infestation of shade and ornamental trees occurred in Victoria, caused by the larvae of an undetermined species of sawfly. In normal years its ravages are confined to the Lombardy poplar (*Populus dilatata*), which is its normal food-plant, but in 1917 it attacked everything in sight, even invading houses and other buildings.

SPEYER (E. R.). **Shot-hole Borer of Tea. Extract from the Report of the Entomologist for the Quarter ending July-September 1918.** *Trop. Agriculturist, Peradeniya*, li, no. 6, December 1918, p. 373.

Experiments on the manufacture of a suitable substance for painting on tea-bushes immediately after pruning showed that a 30 per cent. solution of Indian fish-oil resin soap used as a wash, and a 2 per cent. solution used as a spray, were not sufficiently successful in their effect on the borer [*Xyleborus fornicatus*] to warrant the extensive use of the mixture. Further, 30 per cent., 20 per cent., 10 per cent., 5 per cent. and 1 per cent. solutions tested as insecticides on insects extracted from the galleries showed that the stronger solutions were no more effective than the weaker. Finally it was found that the soap was so caustic that its application by hand was impossible, and all the fish-oil in the mixture was saponified, thus rendering it useless. A strong solution of the soap used as a paint was speedily washed from the bushes by the heavy rains.

Fish-oil resin emulsion proved very effective on a small scale, a strength of about 1 in 3 of water giving the best results. Dorana oil, obtained locally, makes a complete emulsion in 5 parts of water and resin is easily dissolved in it. Its effect as an insecticide is extremely powerful, but it is doubtful if enough of this oil could be obtained to make its use practicable.

The burial of the infested wood of prunings is finally condemned, beetles having emerged when buried at a depth of 9 inches during the south-west monsoon, even after heavy rains. It is essential, however, to bury the leaves and small twigs and to return the ash from the burnt wood to the soil.

FREEMAN (W. G.). **Administration Report of the Acting Director of Agriculture for the Year 1917.**—*Dept. Agric. Trinidad & Tobago, Port-of-Spain.* 1918, 56 pp. [Received 15th February 1919.]

Sugar-cane during 1916–1917 suffered little from attacks of the froghopper, *Tomaspis saccharina*, but later in the year there was a decided recurrence of the pest, and it is expected that the 1918 crop will be reduced in consequence. The search for a non-indigenous parasite of the pest is being continued. Some varieties of cane are undoubtedly more susceptible than others, and it is thought that some connection may be found between susceptibility to attacks of *T. saccharina* and root disease. Some trouble from thrips was experienced by cacao-growers. *Brassolis sophorae* (coconut butterfly) caused considerable damage and was proclaimed a pest under the Plant Protection Ordinance. *Cosmopolites sordidus* (black banana weevil) was found to be attacking bananas in March and until November the practice of searching for and digging out grubs and beetles from the stools was continued. This was expensive and not very satisfactory, and in December, on the recommendation of the entomologist, traps consisting of sliced banana bulbs were placed on the ground between the rows and gave good results. Sliced stems appeared equally successful. Each morning the beetles were collected from the traps, 644 being taken during December, 511 in January, 270 in February and 341 in March, from an area of about $\frac{3}{5}$ of an acre. Mole-crickets were kept in check in a vegetable garden by the use of a

protective collar made of empty cacao shells. On lawns, where they were very destructive, soap and water was poured into the holes and many were caught as they emerged. Trap-lights were tried without success and poison-bait did not materially reduce the numbers. The cotton stainer [*Dysdercus*] was not numerous and was controlled by trapping and hand-picking.

LATHROP (F. H.). **The Rose Leaf-Hopper** (*Typhlocyba rosae*, L.).—*New York Agric. Expt. Sta., Geneva. N.Y.*, Circ. no. 55, 10th May 1917, 3 pp., 2 plates, 3 figs. [Received 13th February 1919.]

Typhlocyba rosae, L. (rose leaf-hopper) occurs almost wherever roses are grown in Europe and America. The eggs are deposited in late autumn just beneath the bark of mature stems and pass the winter in this stage. About the middle of May when rose leaves have become well developed, the eggs hatch and the nymphs upon emergence at once migrate to the under-side of the leaves where they feed. By the end of May the nymph has moulted five times and the adult insect appears. There are two, and possibly three, generations in the course of a summer. The adults of the first generation leave the rose to a large extent and migrate to other plants, where the later generations are produced. Both nymphs and adults puncture the tissues of the leaves, producing minute white spots that are apparent on the upper surface of the leaf. Crimson rambler and other varieties of roses are liable to severe injury, and many other plants, including apple, cherry and many small fruits are attacked. Predaceous and parasitic enemies greatly reduce the numbers of this pest; these include spiders, birds, and an egg-parasite. When it is necessary to resort to artificial measures, roses should be thoroughly sprayed while the insect is in the nymphal stage, using $\frac{3}{4}$ pint nicotine sulphate and 5 lb. soap to 100 gals. water. These applications should be made from the time of hatching to the end of May, preferably while the nymphs are quite young and before the foliage has been damaged.

HARTZELL (F. Z.). **The Cherry Leaf-Beetle.**—*New York Agric. Expt. Sta., Geneva, N.Y.*, Bull. no. 444, December 1917, pp. 749–820, 8 plates, 8 figs. [Received 13th February 1919.]

The bulk of the information concerning *Galerucella cavicollis* (cherry leaf beetle) contained in this bulletin has previously been noticed [see this *Review*, Ser. A, iv, pp. 173, 309, and 341]. Factors mentioned as influencing the natural control of the beetles are the drowning of adults that may be blown in numbers into large bodies of water, as was the case in 1915, when millions of beetles were drowned in Lake Erie, and reforestation, which decreases the amount of the bird-cherry, the principal food-plant. Natural enemies of *G. cavicollis* include the Carabid beetle, *Lebia ornata*, Say, and the cedar wax-wing, *Bombycella cedorum*, Vieill.

LATHROP (F. H.). **Leaf-hoppers injurious to Apple Trees.**—*New York Agric. Expt. Sta., Geneva, N.Y.*, Bull. no. 451, September 1918, pp. 185–200, 4 plates. [Received 13th February 1919.]

Apple trees in New York are especially subject to attack by three species of leaf-hoppers, namely, *Empoasca mali*, Le B., *E. unicolor*,

Gill., and *Empoa rosae*, L. The life-histories and habits of these are noted and compared [see this *Review*, Ser. A, vi, p. 207].

In experiments with these leaf-hoppers as carriers of fire-blight (*Bacillus amylovorus*), positive results were obtained with *E. mali*, but no infections were observed in the associated species and the rôle of these as potential carriers of the disease is doubtful. Natural enemies include various small spiders and Hymenopterous parasites. A common and destructive enemy of *E. rosae* is the egg-parasite, *Anagrus armatus*, Ashm. For protection from leaf-hoppers, soap and nicotine spray should be applied against the younger nymphs, and weeds that harbour the insects should be destroyed.

SEVERIN (H. C.). **Insects and Plant Diseases injurious to Plums and Sand Cherries.**—*9th Ann. Rept State Entomologist S. Dakota for Period ending 30th June 1918, Brookings*, pp. 7–31, 15 figs. [Received 14th February 1919.]

The growing of plums and sand cherries in South Dakota is seriously hampered by insect pests, and proper remedial measures are necessary to save many crops from being ruined. Insects injurious to these fruits include *Samia cecropia*, L., *Mineola indiginella*, Z. (leaf crumpler), the Aphids, *Hyalopterus arundinis*, F. (mealy plum aphis) and *Aphis setariae*, Thom. (rusty-brown plum aphis), *Tetranychus telarius*, L. (*bimaculatus*, Harv.) (red spider), *Bryobia praetiosa*, Koch (*pratensis*, Garm.) (clover mite), *Sphinx drupiferarum*, A. & S. (plum sphinx), *Malacosoma americana*, F. (tent caterpillar) and *Neurotoma inconspicua*, Norton (web-spinning sawfly), all of which attack the leaves. *Conotrachelus nenuphar*, Hbst. (plum curculio) and *Coccotorus scutellaris*, Lec. (plum gouger), attack the fruit. The twigs, branches and trunk are infested with *Aegeria* (*Synanthedon*) *pictipes*, G. & R. (plum tree borer), *Ceresa bubalus*, F. (buffalo tree-hopper), and the scales, *Lepidosaphes ulmi*, L., and *Aspidiotus ancylus*, Putn. General recommendations for spraying are given and the appropriate measures against the various pests enumerated are shown in a table.

VINAL (S. C.). **Control of Insect Enemies of Garden Crops.**—*Commonwealth of Mass. State Bd. Agric. Boston*, Circ., no. 85, June 1918, 26 pp. [Received 24th February 1919.]

This popular bulletin deals with the insect enemies of garden crops under the headings of general feeders, and special or selective feeders, these being arranged in alphabetical order according to the crops attacked. The usual insecticides and methods of use are also given.

MACKIE (D. B.). **Some Aliens we do not want, why we do not want them, and how they may arrive. The European Corn Stalk Borer.** —*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 9, September 1918, pp. 541–545, 5 figs.

In the abstract of this paper that appeared in this *Review*, Ser. A, vii, p. 60, the statement was inadvertently made that *Pyrausta nubilalis* (European cornstalk borer) had been introduced into California from Europe. This is not the case, as the author's remark upon its introduction "to our shores" referred to the Atlantic shores of the United States and not to those of California.

LEGISLATION.

Service and Regulatory Announcements, October-November 1918.— *U.S. Dept. Agric., Washington, D.C.*, Federal Hortic. Board, no. 57, 7th January 1919.

Under a quarantine notice no. 37, the Secretary of Agriculture declares that on and after 1st June 1919 and until further notice the importation of nursery stock and other plants and seeds into the United States from any country is prohibited, except as provided in the rules and regulations supplemental to the notice. In accordance with these regulations, no permit is required for the importation of fruits, vegetables, cereals, and other plant products imported for medicinal, food or manufacturing purposes, nor for field, vegetable and flower seeds. The following nursery stock and other plants and seeds not including those governed by special quarantines and other restrictive orders now in force may be imported from countries that maintain inspection under permit upon compliance with the regulations, but where a particular purpose is specified, for that purpose and no other: (1) lily bulbs, lily of the valley, narcissus, hyacinths, tulips and crocus; (2) stocks, cuttings, scions and buds of fruits for propagation; (3) rose stocks for propagation, including manetti, multiflora, brier rose, and *Rosa rugosa*; (4) nuts, including palm seeds, for propagation; (5) seeds of fruit, forest, ornamental and shade trees, seeds of deciduous and evergreen ornamental shrubs and seeds of hardy perennial plants. Importations of nursery stock and other plants and seeds specified in this regulation, from countries not maintaining inspection, may be made in limited quantities for experimental purposes only, under permit upon compliance with these regulations, but this limitation shall not apply to tree seeds.

Application must be made to the Federal Horticultural Board for a permit for importation of nursery stock and other plants and seeds. Delivery in bond pending receipt of permit will be allowed for shipments from countries maintaining inspection. Permits will be issued upon approval by the Secretary of Agriculture and will be valid until revoked, unless otherwise specified. Inspection, certification and marking are conditions necessary for entry. Nursery stock and other plants and seeds from countries that do not maintain inspection shall not be delivered to the importer or consignee until they have been examined by an inspector of the Department of Agriculture and found to be either free from infestation or capable of being adequately guarded by disinfection. All importations under these regulations shall be subject as a condition of entry to such disinfection as shall be required by the inspector of the Department of Agriculture. The permittee shall give notice of arrival and notice of shipment of his consignment to the Secretary of Agriculture. Any consignment of nursery stock and other plants and seeds not inspected must be clearly marked to show the nature and quantity of the contents, name and address of the consignee, and the country and locality where grown.

In a series of appendices are given a list of plants and plant products that are governed by special quarantines and other restrictive orders, a copy of forms required by the foregoing regulations, and a list of the countries that have provided for inspection and certification in conformity with the requirements of the Plant Quarantine Act of 20th August 1912.

JOHNSON (W. H.). *Ann. Rept. Agric. Dept. Southern Provinces Nigeria for the Year 1917, Ibadan*, 25th July 1918, p. 14. [Received 15th February 1919.]

The most important damage by insects reported during the year was that caused by the scale, *Aspidiotus destructor*. The plants attacked included coconut, oil palm, yams and bananas. Owners of infested plants were advised to remove and burn all affected foliage, and this procedure, aided by the natural parasites of the scale, appeared to check its spread. Unfortunately the apathy of the natives rendered the universal application of this measure impossible.

WILLIAMS (C. B.). **Notes on Some Trinidad Thrips of Economic Importance.**—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain*, xvii, no. 3, 1918, pp. 143–147, 4 plates. [Received 15th February 1919.]

Between 70 and 80 species of thrips have been collected in Trinidad, the majority of which are of very little economic importance. Those dealt with in this paper are all either definitely injurious, definitely beneficial, or are species likely to be confused with some species of economic importance.

Heliothrips (Selenothrips) rubrocinctus, Giard (cacao or red-banded thrips) is the only seriously injurious species in the West Indies. It is entirely a leaf-inhabiting insect and is very rarely seen in flowers. It should not be confused with the thrips commonly found in the flowers of bois immortelle (*Erythrina*) used as shade for cacao, nor with those in the flowers of cacao. No efficient natural enemies have been observed. The fungus, *Sporotrichum globulosum*, has been recorded as attacking it in St. Vincent and a somewhat similar fungus destroys both young and adults in Panama. In Guadeloupe an ant, *Wasmannia auropunctata*, Roger, was observed carrying off young cacao thrips, and the larvae are destroyed by the two species of *Franklinothrips* recorded below and by small Reduviid bugs. *H. rubrocinctus* has been found on leaves of cacao, guava, mango, camphor, *Inga* sp., live oak (*Quercus virginiana*) in Florida, croton (*Codiaeum variegatum*), cashew (*Anacardium occidentale*), kola, grape-vine (*Vitis vinifera*), African almond (*Terminalia catappa*), rose apple (*Eugenia jambos*), and *Sponia micrantha*. It occurs in practically all the West Indian Islands as well as other countries.

Franklinothrips vespiformis, Crfd., is largely, if not entirely, predaceous, and is found on the leaves of various plants, where it feeds on smaller insects and their young, including the young of *H. rubrocinctus*. It can be distinguished from the latter by its larger size and ant-like appearance. It occurs on leaves of guava (*Psidium guajava*), sweet potato (*Ipomoea batatas*), cacao (*Theobroma cacao*), bamboo (*Bambusa vulgaris*), *Lantana camara* and on grass and various low shrubs. Its range includes all the West Indies and Central America. *F. tenuicornis*, Hood, is very similar in appearance and habits but is rarer, and outside the West Indies is only known from Panama. In Trinidad it occurs on leaves of *Inga* spp., cacao, *Hibiscus rosa-sinensis* and *Ipomoea* sp.

Heliothrips haemorrhoidalis, Bch., frequently occurs with *H. rubrocinctus*. It is recorded from every continent, being known

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in Europe and North America as the "greenhouse thrips." In Trinidad it is most numerous on leaves of cacao and coffee, and sometimes on cotton, but is never a serious pest. Other food-plants are guava, camphor, *Passiflora laurifolia*, *Eucalyptus* in Australia, fiddle-wood (*Citharexylum fruticosum*), kola (*Cola acuminata*) in St. Vincent, date palm (*Phoenix dactylifera*) in Barbados, mango (*Mangifera indica*), coconut (*Cocos nucifera*), hog plum (*Spondias lutea*), and ferns in European greenhouses.

Corynothrips stenopterus, Williams, is a pest of cassava (*Manihot utilissima*) and rarely of papaya (*Carica papaya*). The eggs are embedded in the mid-rib and all stages are passed on the leaves. It is fairly general throughout the West Indies. *Frankliniella insularis*, Frankl., is found chiefly on the flowers of Leguminosae. It is numerous on *Erythrina glauca*, and is frequently confused with *H. rubrocinctus*. The eggs are embedded in the petals or other parts of the flower, the larvae living chiefly on the flowers and young seed-pods. It occurs throughout Central America and the West Indies on Lima beans (*Phaseolus* sp.), *Cassia*, *Inga* spp., *Lantana* and many other food-plants. *Physothrips xanthius*, Williams (yellow orchid thrips) severely damages the leaves of *Cattleya* and other orchids. It may be an introduced species and has not as yet been found on wild orchids. *Sedulothrips insolens*, Bagn., is often seen in cacao estates on the trunks of dead or dying trees, where it apparently feeds on small insects and perhaps also on fungi. Trinidad is the only known habitat.

WILSON (H. F.). **A New Genus and Species of Aphid (Hem., Hom.).** —*Entom. News, Philadelphia*, xxx, no. 2, February 1919, pp. 39–40.

The species described in this paper is *Asiphonaphis pruni*, gen. et sp. n., collected on choke-cherry (*Prunus serotina*) during June and July in Wisconsin. Colonies were found at the tips of the twigs in early June, but no alate specimens were found until 6th July. The sexual forms, which were collected on *Prunus*, are readily distinguished from other species found on *Prunus* spp. owing to the absence of nectaries.

DOWNES (W.). **The Apple Maggot in British Columbia.**—*Canadian Entomologist, London, Ont.*, li, no. 1, January 1919, pp. 2–4.

Rhagoletis pomonella (apple maggot), of the occurrence of which there are only three authentic records on the west coast of British Columbia, has been taken in the city of Victoria and all over the Saanich Peninsula wherever its food-plant, *Symphoricarpus racemosus* (snowberry), grows. Berries attacked by the fly do not drop to the ground, and the larvae remain in the fruit till the last vestige of pulp has been eaten. Later they bore through the shrunken skin and pupate among the dead leaves and humus below the bushes. The fly prefers bushes growing on high and dry spots, stunted bushes on hillsides generally having the heaviest infestation. The variety in question is evidently an example of a biological race, similar to, and perhaps identical with that infesting the blueberry. It is very abundant in the Province, but is heavily parasitised by a new species of *Opius*.

ROSS (W. A.). **The Identity of the Wheat Midge in Ontario.**—*Canadian Entomologist, London, Ont.*, li, no. 1, January 1919, p. 16.

In connection with the reappearance in Ontario of the wheat midge or "red weevil" in fairly large numbers in 1917 and in lesser numbers in 1918, it is recorded that the species in question is *Thecodiplosis mosellana*, Gehin, and not, as had been thought, *Contarinia* (*Diplosis*) *tritici*, Kirby.

TREHERNE (R. C.). **The History of the Codling Moth in British Columbia.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 1, January 1919, pp. 19–24, 1 fig.

Since 1905, at least 12, and probably 13 distinct outbreaks of the codling moth [*Cydia pomonella*] have occurred in the province of British Columbia, at widely separated points. A marked increase in the numbers of outbreaks occurred after the year 1912, coincident with a noted rise in the fruit-yielding capacity of British Columbia orchards. Altogether, since 1908 at least 40,000 larvae have been collected and destroyed by hand labour, and at least 50,000 apple trees have been under careful surveillance and inspection during this period.

The following operations are undertaken wherever an outbreak is reported:—All trees are banded; periodical inspections are made of the bands and main tree trunks, (1) in May for overwintering larvae, (2) in early July for the first generation of full-grown larvae, (3) in in late July, (4) in mid-August (optional, according to seasonal development), (5) in September for second generation larvae, (6) in October; windfalls from July onwards are disposed of by boiling and burying; two or three spray applications beginning with the calyx spray are given; all root-sucker growth, loose bark and dead wood are removed from the trees.

The following procedure is adopted for the disposal of the fruit in an infested area:—An order for the formation of a codling moth quarantine area is passed under the authority of the Agricultural Association Act; all tree fruit is inspected before shipment; inspectors are notified when shipments are intended; all fruit is packed in a packing house in the infested area, no fruit being allowed to be handled in a house through which fruit from a non-infested area is passed; all orchard boxes used in quarantined areas must remain in such areas unless passed by an inspector; all fruit in infested areas is loaded into railway cars by the most direct route and no such fruit is allowed to be sold in the Province or for export from Canada; loose or unpacked fruit must not be moved from a quarantined area without permission from an inspector, and no fruit may be stored in cellars or houses without proper inspection; cull fruits must be at once made into cider or apple sauce or be destroyed; railway companies are requested to dispose of the sweepings from fruit cars by burning; refrigerator cars are inspected at as few points as possible, and infested cars are kept closed, iced as soon as possible, loaded locally, or are rejected.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu,* xv, no. 11, November 1918, pp. 458–463. [Received 17th February 1919.]

During September 700, and during November, 496 bags of wheat from Australia were fumigated before delivery, being infested with several species of weevils.

During October two parcels of acorns and chestnuts were fumigated for weevils, and two palms were fumigated for mealy bug.

Protection of Insect-eating Birds in St. Vincent.—*Agric. News, Barbados,* xviii, no. 436, 11th January 1919, p. 15.

It is notified for general information that the following insect-eating birds are fully protected by law in St. Vincent:—Tick bird (*Crotophaga ani*), Barbados blackbird (*Quiscalus fortirostris*), *Tyrannus rostratus, Elainea martinica* and *Ardea caerulea.*

The preservation of these valuable birds is necessary, because they assist materially in controlling pests damaging local crops. For example, the first three are known to feed on the cotton stainer (*Dysdercus delauneyi*) as well as on other insects, and *Ardea caerulea* is a noted enemy of the destructive mole-cricket (*Scapteriscus didactylus*).

HAYWOOD (J. K.). **A Method for Preparing a Commercial Grade of Calcium Arsenate.**—*U. S. Dept. Agric., Washington, D.C.,* Bull. no. 750, 5th October 1918, 10 pp. [Received 21st February 1919.]

Attention has recently been drawn to the use of calcium arsenate as a substitute for lead arsenate, principally because of the cheapness of lime as compared with lead oxide. Though not recommended for use alone on tender foliage, it gives excellent results on some of the more resistant plants, as well as very promising ones when combined with other sprays, especially sulphides, which cause the breaking up of lead arsenate to a greater or less extent.

The best method of making calcium arsenate from lime and arsenic acid consists in:—(1) using a good grade of lime containing a high percentage of CaO; (2) slaking the lime to a paste as smooth as possible, for upon this depends the smoothness of the final product, as well as the readiness with which the lime and acid react. From 3 to 3½ times as much water, by weight, as lime should be used. After standing for a time and then being thoroughly mixed, twice as much hot water as used for slaking should be added. (3) The lime and arsenic should be in such proportion that the weight of actual CaO used will be equal to that of As_2O_5 used. This gives a product with a molecular ratio slightly over 4, which is necessary if the soluble As_2O_5 is to be kept down to desirable limits. (4) The acid, at room temperature, should be added to the lime as quickly as possible, and the liquid should be stirred well until it becomes alkaline to phenol-phthalein. (5) It should be filtered to as dry a state as possible, but not washed, and if a dry product is desired it should be dried directly. (6) It should then be crushed in a suitable disintegrator, or ground if necessary.

To produce 100 lb. of commercial calcium arsenate by this process will require 45 lb. CaO (approximately 50 lb. of a high grade lime) to

be slaked with 18 U.S. gals. water, the addition of 36 U.S. gals. more, and then 45 U.S. gals. of a solution containing 1 lb. As_2O_5 per U.S. gal.

The product should not be designated simply calcium arsenate, but calcium arsenate containing other calcium compounds.

Pennsylvania threatened by European Corn Borer.—*Wkly. Press Bull. Pennsylvania Dept. Agric., Harrisburg, Pa.*, iv, no. 6, 13th February 1919.

Pennsylvania, which produces over 60,000,000 bushels of maize annually, is threatened with the European corn borer [*Pyrausta nubilalis*], the pest having appeared in New York within 200 miles of the State borders.

This moth lives in both sweet maize and field maize, and infests such plants as barnyard grass, pigweed and foxtail grass. It has also been found feeding in dahlia stems, on oats, peppers, celery, beet, spinach, potatoes, tomatoes and beans, its general feeding habits making it a difficult insect to control. Burning all infested vegetation is the only way to combat it. It winters as a larva in the stalks of maize, changing to the adult in May, and the female deposits about 700 eggs which give rise to a second generation in early August. The stalks attacked by the larvae are so weakened that even a light wind causes them to break.

Buxton (Capt. P.A.). **Report on the Failure of the Date Crop of Mesopotamia in 1918.**—*Agric. Directorate, M.E.F.; Basrah*, Bull. no. 6, 1918, 6 pp. [Received 24th February 1919.]

A large proportion of the date crop in Mesopotamia was ruined in 1918 owing to the injury caused by a Pyralid moth, which seems to be present in every date garden and in every kind of date and reduces these to the condition known as "hashaf." The larva eats the flesh of the date along the stone in May and June, causing it to become red-brown and spherical and finally to drop. Before it drops, the larva is full-fed, and leaves the fruit by a small hole bored close to the base of the date, from which frass and silk project. Pupation occurs in June, presumably in the ground, but this has not yet been definitely determined. As far as present knowledge goes, the life-history is somewhat as follows. Hibernation occurs in the pupal stage, the moth emerging in April and May and ovipositing either on the female blossom or on the bunch of young dates very soon after they begin to form. The young larva at once bores into the date and hollows it out. No insect or fungus enemies appear to hold the pest in check and until the life-history is thoroughly known the best method of dealing with it cannot be discovered. It is found that gardens that are well watered and on which vegetables are raised produce excellent dates, while in neglected gardens the dates are very poor. It seems obvious therefore that cultivation under the date palms would do much to reduce the pest.

Minor pests of the date are mites that spin a web over the cluster in early July. Dates so affected develop a scaly irregular skin and do not ripen; they are used as cattle food. Affected clusters should be cut out and burnt. A paraffin and soap emulsion might be used on the smaller trees. A scale-insect, probably *Parlatoria blanchardi*,

sometimes occurs on leaflets of young trees, and may develop into a serious pest as it occurs in all parts of the country. Boring-beetles include at least two species, but only larvae have as yet been obtained. One of these may be *Rhynchophorus ferrugineus*, which bores in the superficial layers of the trunk of mature palms. When abundant it appears to interfere with the nutrition of the palms and renders them liable to break off in high winds. The other species is a Lamellicorn, and bites off the young leaves as they appear and the main stem of the fruit cluster. The larvae of another Pyralid, distinct from that producing "hashaf," attack windfall dates on the ground. Pupation occurs in the ground and lasts from 10 to 14 days. This moth may breed all the year and also infests stored dates.

It is suggested that an entomologist should be detailed to study the life-history and control of the "hashaf" moth, as this damages the crop considerably each year and every few years becomes really serious, as in the season under review.

BEESON (C. F. C.). **Forest Insect Conditions in Gorakhpur Division, U.P.**—*Indian Forester, Allahabad*, xlv, no. 1, January 1919, pp. 10–15.

The insect pests occurring in the sal [*Shorea robusta*] forests of the Gorakhpur division may be classed as borers, defoliators and those infesting young growth.

The complete removal of felling débris, combined with the barking of poles and logs, prevents the continuance of almost all species of borers commonly found in sal forests from the Western United Provinces to Assam. The only species at present able to breed in felled material during the working season are *Sphaerotrypes siwalikensis*, Steb. (sal bark-beetle), *Xylotrechus smei*, L. & G., a small sapwood Longicorn, and *Xyleborus perforans*, Woll., a cosmopolitan and polyphagous pin-hole borer. These occur in stacks and unbarked slabs, but their presence is economically negligible. In sal from the pole to the tree stages, borers with semi-annual and annual life-cycles are endemic, in addition to the species with short life-cycles, the most important of these being *Aeolesthes holosericea*; *Dialeges pauper* also occurs together with *Diapus furtivus*, and a few minor shot-hole borers and Anthribids. Such borers as *A. holosericea*, *D. pauper* and *Xylotrechus smei* have survived because they are polyphagous, breeding commonly in half a dozen of the various trees associated with sal, and because they develop by semi-annual generations which can lengthen the life-cycle to a year if conditions are adverse.

The principle defoliators are the larvae of *Ingura subapicalis*, Wlk., *Plotheia seltis*, Moore, *Suana concolor*, Wlk., *Trabala vishnu*, Lef., *Lachnosterna problematica*, Brenske, *Adoretus caliginosus*, Burm., *Holotrichia* spp. and *Serica* spp., the maximum defoliation taking place in April, May and June. Their economic importance is still a matter of conjecture, but it is probable that, with the extension of blocks of even-aged forest under the uniform system, the effect they produce will become more obvious, and they will be reckoned as the principal pests of uniform forests.

The chief insect pests of sal seedlings in nurseries are grasshoppers, especially *Chrotogonus*, which are accompanied by species of *Teratodes*,

Oedaleus and *Aularches*, together with brown crickets; for their control bag netting and trapping in ditches are necessitated. The principal pests of trees from one to four years old are stem-girdlers that gnaw off the bark or girdle vigorous coppice shoots. The damage is done by the Longicorn beetles, *Batocera rubus*, L., and *Plocaederus obesus*, Gahan, which breed in the wood of *Odina wodier* and numerous other soft woods occurring as unbarked logs and stacks of fuel. The moth shoot-borer, *Pammene theristis*, Meyr., is at present not abundant, but as it bores in successive generations in the seed, seedling roots, and young shoots of sal, it is certain to become a pest of considerable importance in the future.

COULONDRE (E.). **Contre la Cochylis et la Pyrale.** [Measures against *Clysia ambiguella* and *Sparganothis pilleriana*.]—*Progrès Agric. Vitic., Montpellier*, lxx, no. 46, 17th November 1918, p. 459. [Received 19th February 1919.]

The dusting of vines with "chaux-magnésie" is stated to control *Clysia ambiguella* effectively if three treatments are given, the first, 10 days before flowering, the next, during the flowering, sulphur being added, and the last, 8–10 days afterwards, though it is not known whether it is the adults or the larvae that are affected by the treatment.

The use of solutions containing arsenic is absolutely efficacious against *Sparganothis pilleriana*, provided that applications are made in two consecutive years, the best time being 8 days before the opening of the leaves, the pupae being at that time much more sensitive to the action of the solution. This measure applied at the time mentioned is also very destructive to *C. ambiguella*, without, however, giving the absolutely satisfactory results obtained in the case of *S. pilleriana*.

CROUZAT (L.). **La Pyrale – sa Destruction.** [The Destruction of *Sparganothis pilleriana*.]—*Progrès Agric. Vitic., Montpellier*, lxx, no. 51, 22nd December 1918, pp. 586–589.

Vines may be protected from attack by *Sparganothis pilleriana* by careful cultivation of the soil beneath them in winter to kill the pupae; by washing the stems with boiling water, or by fumigating them by means of sulphur matches, or by treating them with cold arsenious acid emulsion applied as a wash or as a spray; by removing the leaves touching the grapes, to prevent the larva from webbing these together and obtaining a shelter from which it may feed on the grape; by adding sodium arsenate, or better still, arsenious acid to the usual spring sprays with Bordeaux mixtures.

PORTIER (P.). **Développement complet des Larves de *Tenebrio molitor*, obtenu au Moyen d'une Nourriture stérilisée à haute Température (130°).** [Complete Development of Larvae of *Tenebrio molitor* reared on Food sterilised at a temperature of 130°.]—*C. R. Soc. Biol., Paris*, lxxxii, no. 2, 25th January 1919, pp. 59–60.

Adult animals fed with nourishment sterilised by prolonged subjection to a temperature above 120° C. [248° F.] suffer in health and finally die, while the same conditions arrest the development of

the young before causing death, the vitamines in the food having been destroyed by heat. This is explained by assuming that sterilisation destroys the symbiotes in the food, and consequently, those in the tissues not being replaced, these latter gradually degenerate and lose their synthetic function, and the condition induced by lack of vitamines results.

Organisms that in a state of nature live on substances lacking symbiotes, such as xylophagous larvae, Aphids, etc., possess a highly specialised symbiotic mechanism, that is, they eat a cryptogamic symbiote-carrier developed at the expense of the woody substances, or their tissues contain enclosed micro-organisms, capable of hereditary transmission. Former research has shown that the epithelial cells of the intestine enclose corpuscles, which are in reality symbiotic micro-organisms. To test the above theory larvae of *Tenebrio molitor* (meal-worm) were experimentally fed on nourishment sterilised at 130°, and these not only grew as rapidly as those normally fed, in some cases doubling their weight in three days, but also developed into normal adults.

CHALOT (C.) & BERNARD (U.). **Culture et Preparation de la Vanille.** [Cultivation and Preparation of Vanilla.]—*L'Agron. Colon.*, *Paris*, iii, no. 21, November–December 1918, pp. 72–86. [Received 18th February 1919.]

The insect pests of vanilla in the island of Réunion include the Psyllid, *Trioza litseae*, Giard, a most destructive pest, which attacks the flower-buds and flowers, often preventing the development of the fruit. Since its alternative food-plant is *Litsea laurifolia*, the best remedy is the destruction of all trees of this species in the neighbourhood of vanilla plantations. *Nezara smaragdula*, F. (emerald bug) sucks the sap from the stem and the floral buds, though the damage done by it is unimportant compared with that of *T. litseae*.

Injurious Lepidoptera include *Conchylis vanillana*, the larva of which attacks the young fruit shortly after fertilisation, either killing it or causing a great depreciation in its value. Since the eggs are laid on the corolla of the vanilla flower after fertilisation has been effected and when it is beginning to wither, the simple and obvious remedy is to remove the floral leaves immediately after fertilisation. *Simplicia inarcualis*, Guén., and *Phytometra* (*Plusia*) *aurifera*, Hb., also occasionally attack vanilla. Two Coleoptera, *Hoplia retusa*, Klug, and *Cratopus punctum*, F., frequently attack the corolla, sometimes, destroying the fruit. The damage due to them, however, is slight compared with that of the Curculionid, *Perissoderes ruficollis*, Waterh., which in Madagascar mines longitudinal galleries often 20 inches long in the stem, with the result that the area attacked blackens and dies. The treatment recommended consists in carefully cutting and burning the parts attacked without delay.

In Madagascar, where *Conchylis vanillana* and *Phytometra aurifera* also occur, their destruction by means of light-traps is recommended.

Memmia vicina, to which attention has already been drawn [see this *Review*, Ser. A, iii, p. 57], is a blackish Pentatomid bug which lives under the leaves and attacks the flowers and fruits, causing them to fall. It seems to appear at the rainy season, and to disappear at the

beginning of the dry season. The use of nicotinated pyrethrum, hydrocyanic acid gas and trap-plants in the neighbourhood of vanilla plantations has been recommended against it.

Both in the colonies and in France, stored vanilla pods are attacked by *Tyroglyphus* sp., a mite that eats the surface of the fruit, especially at the extremities, covering it with a powdery layer and causing a marked depreciation in its value. These mites may be destroyed by exposing the pods to a temperature of 140°–160° F. and by the disinfection of the stores with sulphur.

AKERMAN (A.). **Influence of the Date of Earing on Damage done to Spring Wheat by the Dipteron, *Contarinia tritici*, in Sweden.**—*Sveriges Utsadeforenings Tidskrift, Malmö.* xxviii. no. 2, pp. 90–93, 1918. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* ix, no. 11, November 1918, pp. 1382–1383). [Received 24th February 1919.]

Larvae of *Contarinia tritici* caused considerable damage during 1917 to spring wheat in Sweden. Those varieties were found to suffer most in which the date of formation of the ear coincides with the moment when most of the female insects are about to oviposit. Those in which the ear forms later are less affected.

ELLINGER (T.). ***Cicadula sexnotata*, a Hemipteron injurious to Wheat, Oats and Barley in Sweden.**—*Vort Landbrug, Copenhagen,* xxxvii, no. 40, pp. 453–454, 1908. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* ix, no. 11, November 1918, p. 1383.) [Received 24th February 1919.]

Cicadula sexnotata caused serious damage to wheat in Southern Sweden in 1918, the plants being so distorted as to prevent seed-formation. The insect may migrate from winter wheat to spring-sown oats and barley, causing similar injury. As wheat sown in September appears just when the insects are most numerous, delaying the date of sowing diminishes considerably the intensity of the attack.

DEL GUERCIO (G.). ***Gelechia ocellata*, a Microlepidopteron injurious to the Beet, new for Italy.**—*L'Agricoltura Coloniale, Florence,* xii, no. 4, 1918, pp. 216–230, 5 figs. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* ix, no. 11, November 1918, p. 1384.) [Received 24th February 1919.]

Phthorimaea ocellatella, Boyd (*Gelechia ocellata*, Boisd.), was firs recorded from Italy in 1917 in the neighbourhood of Florence, where it was injuring beet. In July, newly-hatched larvae feed upon the tender leaves of beets and then tunnel into the root, causing the foliage to wither and preventing development of the root. The mature larva leaves the plant in order to complete its life-cycle. An internal parasite of the larvae is a Dipteron belonging to the genus *Masicera*. Various methods of control for *P. ocellatella* have been tried. Arsenical solutions promise good results, and also help to control the fungus, *Cercospora beticola*, and some Cassid beetles that are injurious to beet.

A. L. Trattamento d'Inverno contro la Cochylis. [Winter Treatment against *Clysia ambiguella.*]—*Riv. Agric. Parma*, xxv, no. 7, 14th February 1919, pp. 48–49.

This paper does not contain any new information, but gives a clear description of the various remedial measures applicable in winter, which is the best time for combating this vine-moth.

IMMS (A. D.). **Observations on the Insect Parasites of some Coccidae. II. On Chalcid Parasites of *Lecanium capreae*.**—*Quart. Jl. Micros. Sci., London*, lxiii, no. 3, December 1918, pp. 293–374, 34 figs. [Received 27th February 1919.]

In the first paper of this series an account was given of *Aphelinus mytilaspidis*, Le B., the chief parasite of *Lepidosaphes ulmi* [see this *Review*, Ser. A, iv, p. 241]. The present contribution deals with *Eulecanium* (*Lecanium*) *capreae* and its two abundant Chalcid parasites, *Blastothrix britannica*, Gir., and *Aphycus melanostomatus*, Timb. The host-scale is abundant and generally distributed throughout England, locally in Scotland and Wales, and is plentiful on the Continent of Europe and in North America, its principal food-plant being the hawthorn (*Crataegus oxyacantha*). The life-history is given in detail. Hatching from the eggs begins at the end of June, and the larvae feed upon the under-side of the leaves near the midrib. Shortly before the leaves drop the larvae migrate to the twigs, generally in the axils of buds or the bases of thorns. Very little growth occurs during the winter, but after fertilisation the females grow much more rapidly and mature about the end of May, having then a round, berry-like appearance. Each female lays between one and two thousand eggs, and then rapidly declines in vigour and dies. Parasites of *E. capreae*, previously recorded, include *Eunotus cretaceus*, Wlk., *Eucomys obscura*, Dalm., *E. scutellata*, Swed., *Aphycus punctipes*, Dalm., *Blastothrix sericea*, Dalm., *B. schönherri*, Westw., *Microterys chalcostomus*, Dalm., and *M. sylvius*, Dalm.

Full accounts are given of the two parasites dealt with in this paper. Descriptions are given of each species, and their systematic positions, habits and distribution are discussed. *Blastothrix britannica* has two generations in a year, males and females occurring in approximately equal numbers. The first generation, derived from hibernated larvae, emerge in May and early June. One, or several eggs are deposited in the mature host. The newly-hatched larva remains for a time attached to the chorion of the egg, and then lies free in the body-cavity of the Coccid. Pupation occurs within the host in June, as many as 42 pupae being found within a single scale. The adults of the second generation emerge during July, and oviposit in the young larvae of the host. The larvae hatching from these eggs pass the winter within the host and pupate about April.

A. melanostomatus also has two generations and the stages of the life-history are almost contemporaneous with those of the preceding species. Males are, however, in the proportion of about 1 : 3. A partial third generation of adults has been observed in the case of this species.

The results of the first generation of parasitism in the case of both Chalcids are practically negligible, and egg-production by the host

seems unimpaired. The effects of the second generation are much more marked, about 40 per cent. of the host-scales being attacked and destroyed long before attaining sexual maturity. The abundance of the host is so greatly limited by this parasitism that it seldom attains sufficient numbers to constitute a pest, in spite of its great fecundity. Although the rate of production of *E. capreae* is more than 48 times that of *Lepidosaphes ulmi*, its abundance is checked so much more effectively by parasites that it is a far less important pest.

FULMEK (L.) & KARNY (H.). **Einige Bemerkungen über *Drepanothrips* auf dem Weinstock.** [Remarks on the *Drepanothrips* of the Vine.]—*Zeitschr. f. Pflanzenkrankh., Stuttgart,* xxv, no. 7, 11th Dec., 1915, pp. 393–398, 3 figs.

In Lower Austria in May 1915 a small number of a species of *Drepanothrips* was found on *Vitis riparia*. Only two species of this genus, *D. reuteri*, Uz., and *D. viticola*, Mokr., are known at present, and these are considered by some authorities to be identical.

D. viticola has been recorded from Russia and the Caucasus on the leaves of the vine (*Vitis vinifera*), the female hibernating under the bark and in the ground, and appearing on the leaves in April.

D. reuteri has been recorded in Italy on vines and in Bohemia on the leaves of various trees, particularly oak, beech and hazelnut, the females appearing in August and September and the males in September.

In Sicily it attacks all parts of American vine-stocks (*V. riparia* and others). According to Pantanelli only the female is found in spring on vines. The adults occur on the earliest leaf-buds, and the larvae on both surfaces of the leaf, especially of *V. riparia* and its hybrids in damp places, seldom on *V. rupestris* or in dry places. The eggs are laid singly in the leaf-web. The female hibernates and there are at least two generations a year—one in spring and one in summer.

A table is given of the measurements of the imago obtained by Pantanelli and those obtained by the authors, with the result that the species found in Italy is considered identical with that from Lower Austria. If *D. viticola* is specifically different from *D. reuteri*, which they do not consider to be yet proved, the insect from Lower Austria is in all probability *D. viticola*.

MÜLLER (H. C.) & MOLZ (E.). **Über zwei seltene, aber gefährliche Schädlinge: *Urocystis cepulae*, Frost, und *Galeruca tanaceti*, Leach.** [Two rare, but dangerous pests: *Urocystis cepulae*, Frost, and *Galeruca tanaceti*, Leach.]—*Zeitschr. f. Pflanzenkrankh., Stuttgart,* xxvii, no. 2–3, 25th April, 1917, pp. 103–106, 4 figs.

The second part of this paper deals with *Galeruca tanaceti*, Leach, and the damage done by this beetle to rhubarb, turnips, radishes, onions, potatoes, etc. The first pupae were observed on 5th June and by the 15th of that month all the larvae had pupated, the first imago appearing four days later. The larvae feed on a great variety of plants, only beans and peas being immune. Arsenical preparations should be successful against this pest.

KEILIN (D.). **On the Occurrence of a Cephaline Gregarine, *Leidyana tinei*, sp. n., in Lepidopterous Larvae.**—*Parasitology, Cambridge*, x, no. 3, April 1918, pp. 406–410, 1 fig., 1 plate.

The new Gregarine, *Leidyana tinei*, here described, occurs in the mid-gut of the caterpillars of a moth, *Endrosis fenestrella*, Staint., and is the first Gregarine to be recorded as parasitic in Lepidoptera. Related species are *L. erratica*, a parasite of *Gryllus abbreviatus*, Serv., and of *G. pennsylvanicus*, Burm., and *L. gryllorum*, a parasite of *G. domesticus*, L.

SPEYER (E. R.). **The Distribution of *Xyleborus fornicatus*, Eich. (Shot-hole Borer of Tea).**—*Ceylon Dept. Agric., Peradeniya*, Bull. no. 39, August 1918, 34 pp.

This bulletin deals with the history of *Xyleborus fornicatus* in Ceylon, and gives a detailed list of estates and tea gardens infested to 7th June 1918. A list showing its vertical distribution is also given, which indicates that the elevation at which it is now particularly abundant is about 2,000 ft. above sea-level. In 1903 this beetle was certainly established at elevations of about 4,000 ft., and there does not seem much doubt that it spreads gradually upwards, attaining an altitude of 5,000 ft., though it becomes less common when 4,000 ft. is reached, and above 4,500 ft. it is no longer a serious pest. The reason for its being less common at elevations above 4,000 ft. is that development is longer by a period of some 3 weeks, as compared with that at 2,000 ft. or under. At very low elevations, 100 to 1,000 ft., the beetle becomes again less abundant. The districts in question are, however, extremely wet, and this may in part account for the marked falling off in the infestation.

CARPENTER (C. W.). **A New Disease of the Irish Potato.**—*Phytopathology, Baltimore, Md.*, viii, no. 6, June 1918, pp. 286–287.

A new disease of potatoes in Hawaii was first observed near Honolul in May 1917, but was subsequently found to be prevalent and destructive in all the potato sections of the islands. This disease takes the form of the drying up and death of the plants from the growing tip downwards, and is caused by the presence of myriads of minute mites, being especially prevalent when there is a minimum of rainfall.

A similar disease of the tomato has been recorded from Florida which is due to the attack of another mite, *Eriophyes* (*Phytoptus*) *calacladophthora*, Nal., and a disease of litchi, caused by an undescribed species of *Eriophyes*, is described as prevalent in Hawaii.

With an average rainfall the mites do not appear to become established, but in dry years the losses due to them may be from 5 to 50 per cent. or more. Where potatoes are healthy except for the mites, spraying with lime-sulphur or dusting with dry sulphur has been found an effective remedy. For lowland plantings the suggestion is usually made that seed should be planted in the autumn or winter months so that the crop may mature before the dry season begins.

DRAKE (C. J.). **Two New Tingids from the West Indies (Hem.-Heter).**—*Ohio Jl. Sci., Columbus*, xviii, no. 5, March 1918, pp. 174–176.

The species described are *Leptodictya bambusae*, sp. n., taken on the leaves of bamboo, *Bambusa vulgaris*, in Porto Rico and probably closely allied to *L. tabida*, H.-S., the sugar-cane Tingid, and *Leptostyla mcelfreshi*, sp. n., from Haiti.

FENTON (F. A.). **The Parasites of Leaf-hoppers. With Special Reference to the Biology of the Anteoninae.**—*Ohio Jl. Sci., Columbus*, xviii, nos. 6, 7, 8, April, May, June 1918, pp. 177–212, 243–278, 285–296, 5 figs., 6 plates.

Leaf-hoppers are subject to attacks in all stages by various parasites, including Hymenoptera, Diptera and Strepsiptera in North America, the ANTEONINAE being the most important Hymenopterous ones in northern Ohio. These Dryinids are found in all parts of the world and, so far as is known at present, confine their attacks to the Fulgorids, Cicadellids and Membracids. They are themselves parasitised by Encyrtids and Eulophids.

The oviposition period begins soon after emergence and lasts probably a month in nature, the largest number of eggs obtained in captivity being 13. The egg is very minute and often thrust deeply into the body of the host. It is probably true that the great majority of Dryinids hibernate as larvae within the cocoon, there being apparently no difference in the structure of the winter and summer cocoons. The number of generations a year depends upon the species of host attacked and upon the climate.

The larva of *Aphelopus* introduces some toxic substance into the tissues of the host or otherwise stimulates the abnormal development of the hypodermal tissues into a hypertrophied cell mass, at the expense of the gonads, which fail to develop. Species of *Gonatopus*, *Hoplogonatopus* and *Chelogynus* parasitising the nymphs prevent further development of the host. Adults that become parasitised by members of these genera, may still reproduce at first, but reproduction is rapidly impaired or entirely stopped.

The classification of this subfamily is dealt with, keys to the genera and species being given.

DAVIDSON (W. M.). U.S. Bur. Entom. **The Convergent Ladybird Beetle** (*Hippodamia convergens*, **Guérin**) **and the Barley-corn Aphis** (*Aphis maidis*, **Fitch**).—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 1, January 1919, pp. 23–26, 2 figs.

A brief record is given of experimental work undertaken in the Imperial Valley of California in 1918, to determine the value and practicability of the natural control of *Aphis maidis* by *Hippodamia convergens*. Early barley appears above the ground in this locality before Christmas and continues to grow until June. In 1918, every field examined was infested with Aphids, the attack beginning when the barley was four or five inches high, and reaching its maximum intensity between mid-February and mid-April. From 70 to 95 per cent. of the heads became infested, but as the time for heading out approached, the Aphids became much more scarce, developing wings and forsaking the host, and grain well headed was generally free from

Aphids. Maize is planted in April and May, and a very heavy infestation of this crop occurred in May. Adults of native *Hippodamia convergens* passed the winter in the valley and appeared in the barley-fields in February. The presence of a few larvae at this time showed that breeding and oviposition began very early in the year, and may have been continuous throughout the winter. At no time were the native beetles sufficiently abundant to limit the number of Aphids to any appreciable extent. The native species is, however, extremely prolific, 8 females depositing an average of 334 eggs, while the life-cycle occupied from 17 days in May to 30 during February-March. In captivity, adults and larvae readily devoured *Aphis maidis*, *A. pseudobrassicae*, *Myzus persicae* and *Acyrthosiphon* (*Macrosiphum*) *pisi*. Imported colonies of *H. convergens* under normal conditions proved slightly more prolific than the native species. Individuals that had been kept in cold storage at 31° and 43° F., for eight weeks or more were not very successful and were of impaired vitality; those released after six weeks or less in cold storage were sluggish for a few days and then became normal; those released from a temperature of 58° F. became active immediately. It was found impossible to confine the liberated beetles to a given area, even if heavily infested with Aphids, owing to the rapidity with which they dispersed upon liberation; it is therefore obvious that some time must elapse before the maximum benefit can be expected. Observations upon the value of this method of control are being continued.

Condit (I. J.). **Insect Pests of the Avocado.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 1, January 1919, pp. 27–29, 4 figs.

California is fortunately free from the more important insect pests of avocado found in other countries. Minor pests that occur include the Bostrychid, *Polycaon confertus*, Lec. (twig borer), found burrowing shallow tunnels in small trees, weakening the branches until they were easily broken off. Injured branches should be collected and burnt. On larger trees the pest might become serious, but this is not considered a likely contingency owing to the large range of both wild and cultivated food-plants of this beetle. The June beetle, *Serica alternata*, does some injury to the foliage. A thrips, *Heliothrips haemorrhoidalis*, Bch., causes spotting of the leaves and also of the fruit. A tobacco spray would probably control it. The citrus mealy bug [*Pseudococcus citri*] has been noticed infesting avocado trees, being most plentiful on the fruit stalks, and on the twigs in the axils of leaves, etc., and occasionally becoming a serious pest. Another injurious insect found on avocado is an unidentified miner, the galleries of which have been observed in the bark of tender branches in various parts of southern California. The removal and destruction of infested branches is advocated.

Maskew (F.). **Quarantine Division. Reports for the Months of October and November, 1918.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 1, January 1919, pp. 30–33.

The following insect pests were intercepted during October and November:—From Central America: *Pseudococcus* spp., *Aspidiotus cyanophylli* and *Chrysomphalus scutiformis* on bananas. From Chile:

an undetermined weevil in maize-fodder. From China: Lepidopterous larvae in dried fruit and weevils in sweet potatoes. From Hawaii: *Coccus longulus* on betel leaves; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; larvae of *Ceratitis capitata* in coffee berries. From Holland: *Merodon equestris* in bulbs. From Japan: Lepidopterous larvae in dry bulbs. From Oregon: larvae of *Anarsia lineatella* in peaches. From Pennsylvania: undetermined Aphids on *Hibiscus*. From Florida: *Aspidiotus camelliae* on avocado pear. From Idaho: *Leptinotarsa decemlineata* and *Hypera variabilis* (*postica*) in potato cars, *Cydia pomonella* on apples, and *Aleurodes* spp. on *Chimaphila menziesii*. From Iowa: *Aegeria* (*Sesia*) *rutilans* in strawberry plants. From Mexico: *Calandra oryzae* in maize; *Saissetia oleae* and *Coccus hesperidum* on citrus foliage; *Bruchus obtectus* in beans; *Chrysomphalus aurantii* on sweet limes; *Lepidosaphes beckii* on oranges. From New Mexico: *Cydia pomonella* on apples. From Manila: egg-clusters of *Pseudococcus* on a pot-plant. From Michigan: *Lepidosaphes ulmi* and larvae of *C. pomonella* on apples. From Missouri: *Aspidiotus perniciosus* on plum trees. From New York: *Pseudococcus* and *Aleurodes* spp. on *Gardenia*. From New Jersey: *Aspidiotus* spp. on orchids. From Nicaragua: undetermined weevils in wild cotton-bolls. From Panama: *Phomopsis citri* on grapefruit. From Texas: *Cylas formicarius* in yams. From Virginia: *Balaninus caryatrypes* in chestnuts. From Tahiti: *Euscepes batatae* and larvae of undetermined weevils in sweet potatoes. From Washington: *Aspidiotus perniciosus*, eggs of undetermined Tetranychids, *Lepidosaphes ulmi* and *Eulecanium* (*Lecanium*) *corni* on apples.

VAYSSIÈRE (P.). **Sur les Champignons Parasites des Insectes.** [Concerning the Fungous Parasites of Insects.]—*Bull. Soc. Nat. Acclimat., Paris*, lxvi, no. 2, February 1919, pp. 33–37.

The various attempts that have been made to control insect pests by means of disseminating fungus spores among them, and the results that have been obtained from these experiments, are briefly reviewed. The examples quoted indicate that the problem is by no means solved. It is not sufficient to disseminate a fungus in order to produce an epizootic, since conditions must also be favourable for its development. There is, moreover, a certain stage in the development of the insect when it is most susceptible to infection; at others it is able to offer complete resistance to the attacks of disease. Various fungi have different methods of infection: some penetrate the integument of the insect, some the digestive tract and some the respiratory system. Any fungus epidemic is almost entirely dependent upon weather conditions; as a rule, damp, cool weather is essential for the production of an epidemic and no dissemination of spores during a dry, warm season would give any success. The question requires further study in all its aspects.

FRENCH, Junr. (C.). **The Rutherglen Bug** (*Nysius vinitor*). **A Destructive Pest to Potatoes, Tomatoes, Grapes, Peaches, etc.**—*Jl. Dept. Agric. Victoria, Melbourne*, xvi, no. 12, 10th December, 1918, pp. 738–740, 5 figs. [Received 5th March, 1919.]

Nysius vinitor (Rutherglen bug) is considered one of the worst pests of fruit and vegetables, the greatest damage being done during

the period from October to January, when the insects are most abundant and cause heavy losses by puncturing the fruit they attack. They have also been responsible for a considerable reduction in honey production in Victoria owing to their swarming on the flowers of *Eucalyptus* and other plants and abstracting the nectar. Fortunately the bugs only appear in great numbers once or twice in every few years. Recommendations for remedial measures include the use of benzole emulsion (1 lb. to 5 gals. water), kerosene or tobacco sprays. Smudge fires at intervals among the trees and sprinkled with a little sulphur have been very successful in Victoria. A spray tried with good results consisted of 1 quart phenyle and 3 lb. washing soda added to a solution of 2 lb. yellow soap in 40 gals. water. All contact sprays should be applied on dull days towards evening. Shaking the insects from the trees, before sunrise, into a pan of kerosene and water destroys large numbers of them; kerosene torches have also been used with good results. As the eggs are deposited on stems, grass, weeds, or rubbish on the ground, clean cultivation is of great assistance in exterminating this pest.

Illingworth (J. F.). **Cane Grub Investigation.**—*Queensland Agric. Jl., Brisbane*, xi, no. 1, January 1919, pp. 29–30.

In his report to the General Superintendent of the Bureau of Sugar Experiment Stations the author lays emphasis on the value of cultivation as a remedial measure for sugar-cane grubs, especially during the oviposition period of the beetles, and hence also on the value of late planting.

The artificial breeding of parasitic wasps of the genus *Campsomeris* having proved so successful, it is suggested that good results might follow from their liberation in countries where they would be free from their natural enemies, which are so abundant in their natural habitat as largely to nullify their beneficial effect. The transportation of these parasites would also be rendered easy owing to their lengthy pupal period.

During 1918 the green beetle, *Callodea punctulatus*, and *Lepidiota albohirta*, *L. caudata* and *L. froggatti*, emerged in large numbers about the middle of October when the rains occurred.

Both second and third stage larvae of *L. frenchi* change with the advent of hot weather during October, the latter pupating after having spent nearly a year in the third larval stage, at the beginning of which they do their worst damage to sugar-cane. Fortunately this species is only troublesome on new land, as the beetles do not oviposit in old fields.

Weevil in Wheat.—*Jl. Dept. Agric. S. Australia, Adelaide*, xxii, no. 4, November 1918, pp. 351–352. [Received 5th March 1919.]

The view is expressed that the presence of weevils [*Calandra*] in wheat is largely due to the change in harvesting methods in Australia, the introduction of the harvester and reaper-thresher rendering possible the beginning of harvest about a week earlier than was formerly the case. As a result of this the wheat is often

bagged in a moist condition, or the bags are left standing on the damp ground and readily become infested with weevils. If the wheat is perfectly ripe when stripped, and dry when stacked, much loss from this cause may be avoided.

Hill (G. F.). **History of Citrus Canker in the Northern Territory.**—*Northern Territory Australia Dept. Home and Territories* [*sine loco*], Bull. no. 18, October 1918, 8 pp., 8 plates. [Received 17th March 1919.]

Citrus canker, which is now known to occur in the United States of America, the Philippines, Japan, China, Java, Singapore and the Northern Territory of Australia, was probably introduced into the last-named region from China or Japan. The infection of leaves, leaf-petioles and young twigs frequently follows the course taken by the caterpillars of *Phyllocnistis citrella*, Stn. (citrus leaf-miner).

Froggatt (W. W.). **The Passion Vine Longicorn Beetle (*Monohammus fistulator*).**—*Agric. Gaz. N.S.W., Sydney*, xxx, no. 1, January 1919, pp. 37–39, 4 figs.

Monochamus fistulator has a very wide distribution and has been found in New South Wales severely infesting passion-vines; it has also been bred from the stems of cultivated figs in Sydney, but as yet no native food-plant has been found. The first beetles were obtained from passion-vines early in October, larvae and pupae continuing active in the stems until the end of December. Eggs are laid singly in or upon the bark close to the ground, the larva feeding upwards through the central portion of the stem for a distance of 3 or 4 feet before it is mature. Occasionally, however, the larvae burrow down through the main roots underground. It is suggested that painting the stems of passion-vines with a lime and sulphur wash from October to January might deter the beetles from ovipositing in the bark. During this period also the cut made in the bark by the beetles when ovipositing can be seen and the eggs could be searched for and destroyed. Dead timber is frequently used by the beetles for oviposition and its presence is therefore a source of danger.

Hill (C. C.). **Control of the Green Clover Worm in Alfalfa Fields.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 982, September 1918, 7 pp., 6 figs. [Received 7th March 1919.]

The Noctuid moth, *Plathypena scabra*, F. (green clover worm), has been recorded recently as severely damaging lucerne in the central part of the United States, and, should its natural enemies become reduced, it might become one of the worst lucerne pests. While generally confined to leguminous crops, the caterpillars feed readily upon strawberry and blackberry plants and several common weeds. From 200 to 600 eggs are deposited by each female, generally occurring singly on the under-side of the leaf. They hatch in about 4 days, the larva moulting 5 times before reaching maturity and feeding for about 4 weeks, after which it descends to the ground, and pupates just beneath the surface. There are four generations of this moth in Tennessee, and further north only two or three. The moths hide

during the day and become active at dusk. The adults hibernate in sheltered places such as barns or haystacks. Many larvae die during a continued frost, and numbers are killed by parasitic insects. The best method of controlling the numbers of *P. scabra* is to cut the crop so as to remove the food supply at the moment when the caterpillars are most abundant. Clean cultivation and the destruction of weeds in the vicinity should also be practised. The hopper-dozer might be used with advantage in the case of particularly bad outbreaks.

PHILLIPS (W. J.). **The Wheat Jointworm and its Control.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1006, October 1918, 14 pp., 17 figs. [Received 7th March 1919.]

The Chalcid, *Isosoma* (*Harmolita*) *tritici*, Fitch (wheat jointworm), ranks next to the Hessian fly [*Mayetiola destructor*] as a wheat pest in the wheat-growing States east of the Mississippi and in parts of Missouri. The method of infestation is described and illustrated, the injury causing the wheat stems to bend over to such an extent that the heads are lost when the wheat is cut. The life-history, the damage done to growing wheat, and the control exercised by natural parasites have been described in a previous paper [see this *Review*, Ser. A, v, p. 213]. This pest can be controlled in Virginia, Tennessee and Kentucky by ploughing in the wheat stubble deeply directly after the harvest. It is suggested that rye should be substituted for wheat in the more northern States, such as Michigan, where injury is severe.

KALMBACH (E. R.). **The Crow and its Relation to Man.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 621, 16th February 1918, 92 pp. [Received 7th March 1919.]

Animal food forms only 28·14 per cent. of the yearly sustenance of the adult crow (*Corvus brachyrhynchos*), but it is of greater economic importance than the vegetable portion, the crow being primarily carnivorous and the vegetable matter being eaten more from necessity than from choice. The greatest proportion of animal food is consumed in May (52·44 per cent.) followed by a uniform decrease till the minimum (11 per cent.) is reached in February. The figures quoted in this paper have resulted from the examination of the stomachs of 1,340 adults and 778 nestlings collected in 39 States, the District of Columbia, and several Canadian Provinces.

These investigations have shown that insect food is taken by adult crows in every month of the year, though in January it amounted to only 1·29 per cent., the insects identified belonging to 12 orders. The diet of nestling crows comprises 83·49 per cent. of animal food, of which insects form the major portion, 48·36 per cent. Scarabaeid beetles, especially *Lachnosterna* (*Phyllophaga*) spp., are the most important Coleoptera eaten, both by adults and nestlings. In the former case they constitute 4·28 per cent. of the annual food, and in the latter, the beetles and their larvae often form the sole diet; hence the effect of the presence of this bird on May beetles is of the greatest importance. Other Scarabaeids eaten by both adults and nestlings are *Euphoria inda*, occasionally injurious to ripening fruits, especially

peaches and pears, *E. fulgida* and *E. sepulchralis*, *Ligyrus gibbosus* (carrot beetle) which is most injurious in the adult stage, *Dyscinetus trachypygus*, *Allorrhina* (*Cotinis*) *nitida*, *Anomala* spp., *Cotalpa lanigera*, *Aphodius granarius*, *Canthon* and *Geotrupes*. *Copris*, *Onthophagus* and *Phanaeus carnifex* have also been found in the stomachs.

Carabids constituted 1½ per cent. of the yearly food of adult crows examined, but nearly 4 per cent. of the food of nestlings compared with 5½ per cent. of that of adults during the same period, and comprised *Calosoma calidum*, *C. externum*, *C. scrutator*, *C. willcoxi*, *Pasimachus*, *Chloenius*, *Scarites*, *Harpalus*, *Euarthrus*, *Pterostichus*, *Amara*, *Anisodactylus* and *Cratacanthus*.

The crow can not be considered an important factor in the control of weevil pests as a whole, these insects forming only ·59 per cent. of its food. The only ones worthy of note eaten by adults and nestlings are *Hypera punctata* (clover-leaf weevil) and *Epicaerus imbricatus*. Other miscellaneous beetles comprise nearly 1 per cent. of the crow's annual food, including small numbers of Silphids, Staphylinids and Histerids, but only a very small number of Elaterids (click beetles) and their larvae (wireworms) have been found. Reports render it probable, however, that the crow is a more effective enemy of the latter than stomach examination indicates, doing good work during outbreaks of these insects.

In many respects Orthoptera constitute the most important insect food of the crow which annually consumes them to the extent of 7·34 per cent. of its food, the bulk of this being taken during the latter half of the year. Grasshoppers form by far the greater part of the Orthoptera eaten by the adults, while the nestlings, which require still larger quantities of food for their rapidly growing bodies, are of even greater value in regions where these insects are plentiful. Crows have apparently no preference as to the species of grasshoppers eaten, but several of the most destructive forms, especially *Melanoplus femur-rubrum* (red-legged locust), *M. bivittatus* (two striped locust), *M. atlantis* (lesser migratory locust) and *Brachystola magna* have been recognised. GRYLLIDAE (crickets) are eaten to some extent and LOCUSTIDAE comparatively rarely, the latter being of little economic importance over much of the crow's range, with the exception of *Anabrus simplex* (western cricket), a notorious pest in the northwest.

Lepidopterous larvae, being soft and easily digested are among the first items supplied to newly-hatched young, of whose yearly sustenance they form 5·34 per cent. compared with only 1½ per cent. of that of the adult bird. Noctuids (cutworms) were found more frequently than the larvae of any other family, among those identified being *Alabama argillacea* (cotton worm), *Cirphis unipuncta* (army worm), and *Laphygma frugiperda* (fall army worm). In a limited number of cases the larvae of *Hemerocampa leucostigma* (tussock moth) and *Palaeacrita vernata* (spring canker worm) and the eggs of *Malacosoma americana* (tent caterpillar) have been found.

Bugs of various kinds form less than 1 per cent. of the annual food of the crow, but 2·6 per cent. of that of nestlings, Pentatomids of the genera *Podisus*, *Euschistus*, and *Brochymena* being most often found, but never in large numbers. *Tibicen septemdecim* (periodical cicada) stands out prominently among the Homoptera as an article of diet, forming sometimes 31 per cent. of the food of young birds.

Diptera form a very small and relatively unimportant part of the crow's food, constituting less than half of 1 per cent. Tipulids (crane-flies) are of the greatest economic interest, the adults, pupae and larvae (leather-jackets) being eaten. Muscid and Sarcophagid flies, their puparia and larvae were present in many stomachs examined, occurring in considerable numbers in the case of some nestlings.

The quantity of Hymenopterous insects taken by the crow is so small that the economic considerations involved are practically negligible, the same being true of miscellaneous insects, mainly aquatic forms eaten in marshy regions.

McKay (J. W.). **Annual Report Karimganj Agricultural Experiment Station for the Year ending 30th June 1918.**—*Ann. Rept. Agric. Expts. & Demons. in Assam for Year ending 30th June 1918, Shillong*, 1918, pp. 87–88. [Received 8th March 1919.]

Very little damage was done to farm crops by insects during the year under report. *Leptocorisa varicornis* (rice bug) is the cause of very severe annual damage to the rice crops, particularly to the early varieties. It is best kept in check by the method described in the previous report [see this *Review*, Ser. A, vi, p. 186].

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. St. Vincent for 1917–18, Barbados*, 1919, pp. 12–14. [Received 10th March 1919.]

The subject matter of this report dealing with insect pests has already been noticed from another source [see this *Review*, Ser. A, vi, pp. 454–455].

Morrill (A. W.). **Report of the Entomologist. Notes on Important Insects of the Year.**—*9th Ann. Rept. Arizona Commiss. Agric. & Hortic. for Year ending 30th June 1917, Phœnix*, 30th December 1917, pp. 15–61, 24 figs. [Received 10th March 1919.]

The outstanding entomological features of 1917 in Arizona were damage by *Aphis maidis*, Fitch (corn aphis), the first record of notable damage by *Elasmopalpus lignosellus*, Zell. (lesser corn stalk borer) and severe injury to peaches in a few orchards by *Anarsia lineatella*, Zell. (peach twig borer). This last-named moth is generally distributed over the United States, also attacking, but less injuriously, almond, apricot, plum and prune trees, and it is impossible to say from its distribution, whether it has been present, unnoticed, for several years, or has been introduced recently. The earliest injury is caused by the pest boring into the buds and tender shoots, and the same generation may destroy the young fruit in March, while adult moths may appear as late as the first of November. The injured fruit is subject to secondary attack by *Carpophilus hemipterus* (dry fig beetle). *A. lineatella* may be successfully controlled by spraying with lime-sulphur solution of the same strength as for San José scale [*Aspidiotus perniciosus*], just before the blossoms appear. The Cossid moth, *Prionoxystus robiniae*, Peck. (carpenter worm), a well known pest of oak, poplar, cottonwood, willow, black locust tree and

elm caused the first damage to pear trees recorded of it. The life-cycle occupies 3 years from the time the egg is laid, the adults usually appearing in June and July. Trees in infested orchards should be watched closely from March to July and the young larvae cut out with a knife, if possible before they penetrate into the heart wood. A Cerambycid, closely related to *Ptychodes trilineatus* (three-lined fig-tree borer) was bred from a larva damaging a fig-tree. Unripe apricots were found to be seriously scarred by a species of thrips, *Frankliniella morrilli*, Morg., the injury being done by the nymphs which remained in groups on the surface of the fruit and were most numerous early in April. Good results were obtained by spraying with a nicotine sulphate soap solution under a pressure of at least 150 lb. The Nitidulid beetle, *Conotelus mexicanus*, Murr., was found in large numbers on cucumber and cotton blossoms, and fruit buds may require to be protected from them by the use of repellent sprays.

The adults of a Scarabaeid beetle, *Chnaunanthus discolor*, Burm., were found in April damaging the blossoms in young citrus orchards, but this insect is not expected to become an important citrus pest. A termite, *Amitermes tubiformans*, Buckley, was found doing considerable damage to a citrus orchard, but was successfully controlled by scooping out a basin round the base of each tree and pouring into it ½ pint of Black-leaf 40 diluted at the rate of 1 part to 500 parts water, and at the same time destroying the galleries formed by the termites. Other normal citrus injury resulted from the attacks of *Scirtothrips citri*, Moulton (citrus thrips), *Cicada cinctifera*, Uhler (citrus cicada), and *Melanoplus differentialis*, Thos. (differential grasshopper). The indigenous scale-insect, *Diaspis celtidis*, Ckll., a general pest of ash trees was found on olive to a slight extent, and since the lightest infestation results in considerable financial loss, ash trees should not be planted near commercial olive orchards.

Field and forage crops were attacked by a grasshopper, *Melanoplus differentialis*, which in one district attacked several hundred acres of lucerne, spreading thence to orchards and cotton fields. Another species, *Conozoa behrensi*, Sans., damaged young barley planted in Bermuda-grass sod-land. *Feltia annexa*, Tr. (granulated cutworm) was exceedingly destructive to lucerne, but was checked by the use of poison bran mash. *Aphis maidis*, Fitch (corn-leaf aphis) was exceptionally destructive, spring-sown barley being practically all destroyed by it and by *Siphonaphis padi*, L. (*A. avenae*, F.) (oat aphis). *Colias* (*Eurymus*) *eurytheme*, Boisd. (alfalfa butterfly) was unusually abundant. Severe local damage to field crops was done by *Diatraea zeacolella*, Dyar (larger corn stalk borer), and *Elasmopalpus lignosellus*, Zell. (lesser corn stalk borer), injuring maize and bean plants. *Tetranychus telarius*, L. (*bimaculatus*, Harv.) (two-spotted red spider) caused noteworthy damage to lucerne, the immediate cutting of which and spraying with atomic sulphur or potassium sulphide was advised. Injury from *Heliothis* (*Chloridea*) *obsoleta*, F. (corn ear worm), *Bruchophagus funebris*, How. (alfalfa seed Chalcid) and *Stictocephala festina*, Say (three-cornered alfalfa hopper) was normal.

Cutworms were particularly abundant and destructive to vegetable crops, and the use of a dry poison-bait is recommended made up of 20 to 30 lb. dry bran, middlings, or a half and half combination of

these, with 1 lb. Paris green thoroughly mixed in. The Coccinellid, *Epilachna corrupta*, Muls., was more destructive to beans than usual, the maximum damage occurring in July, but it was successfully controlled by spraying with lead arsenic. *Leptinotarsa decemlineata*, Say (Colorado potato beetle) was very destructive in some districts and a spray of powdered lead arsenate at the rate of 2 lb. to 50 U.S. gals. water was advised. Other pests damaging vegetable crops were *Lygus* sp., the grasshopper, *Eucoptolophus subgracilis*, Caud., *Heliothrips fasciatus*, Perg., and *Diabrotica vittata*, F. (striped cucumber beetle). *Trichobaris mucorea*, Lec., erroneously recorded in a former report as *T. trinotata* [see this *Review*, Ser. A, iv, p. 319], was not found in potato fields during the year, but was present, apparently in its usual numbers, on jimson weed growing near potato fields.

Cotton was attacked during 1917 by a new thrips, *Thrips arizonensis*, Morgan, and also by a small beetle, *Myochrous longulus*, Lec., the latter under circumstances already noticed [see this *Review*, Ser. A, vi, p. 22]. A termite, a species of *Reticulitermes*, was found destroying about 1 per cent. of cotton-stalks by severing them 2 or 3 inches below the surface of the ground. *Heliothis obsoleta*, F., was more destructive in 1917 than at any time since commercial cotton growing had been undertaken. A new type of injury has been credited to this pest on the evidence of finding a single specimen, parasitised by *Sarcophaga helicis*, Town., in an injured stalk. This injury is caused by the young larvae attacking the cotton stalk about 6 inches from the growing tip and tunnelling upwards and downwards for about 3 inches. Grasshoppers, especially *Melanoplus differentialis*, did some damage to cotton, but they were promptly checked wherever they appeared by means of poison bran mash. The formula for this now most generally recommended consists of a mixture of 25 lb. bran, 2 U.S. qts. molasses, 1 lb. Paris green, 3–6 finely chopped lemons or oranges and water to make a crumbly mash. The cost of this may be reduced by the substitution of cantaloups for lemons, the omission of the molasses for use against the adult grasshoppers and the use of a half and half mixture of bran and sawdust in place of the bran. Tarnished plant bugs from cotton were identified as *Lygus elisus* var. *hesperus*, Knight, and *L. pratensis oblineatus*, Say. They appear to breed upon lucerne for the most part, and, when practicable, it would be wise to avoid planting cotton in a field adjoining lucerne.

Of those insects affecting stored food products, *Rhizopertha dominica*, F. (lesser grain borer), *Ephestia kühniella*, Zell. (Mediterranean flour moth) and *Calandra oryzae*, L. (rice weevil) were as injurious locally as in 1913, but have not been found in some of the largest flour mills in the State. *Sitotroga cerealella*, Ol., did considerable damage to a small lot of stored wheat in 1917. *Cathartus gemellatus*, L. (square necked grain beetle) and *Calandra oryzae*, L. (rice weevil) were found in a granary destroying large stores of wheat and rolled barley, but were practically eliminated by fumigating with carbon bisulphide. Stored mesquite beans are specially subject to attack by insect pests, one that was particularly abundant having been identified as *Bruchus prosopis*, Lec.

A small bark-boring beetle, *Pteleobius imperialis*, Eich., has been discovered practically killing young ash trees, and where these are used for shade trees it may prove a serious pest.

SCHOENE (W. J.). **Oriental Peach Moth.**—*11th Rept. State Entomologist & Plant Pathologist Virginia, 1916–1917*; *Richmond*, 1918, pp. 6–7. [Received 12th March 1919.]

The oriental peach moth, *Cydia* (*Laspeyresia*) *molesta*, has been re-introduced into the United States from Japan, a single specimen having been reared from a shipment of pears received at Seattle, Washington. Accounts of this pest have already been noticed [see this *Review*, Ser. A, v, p. 75 and vi, pp. 369 and 373]. It is stated that the larvae may attack the fruit at places other than the point of attachment of the stem, especially where the skin has been already injured. If the fruit is ripe, or nearly so, the entrance point of the larva may be invaded by brown-rot fungus, the larva often continuing its development in the fungus-invaded and decaying flesh of the peach, which under these combined attacks may fall to the ground.

FROMME (F. D.) & SCHOENE (W. J.). **Dusting and Spraying for Apple Scab and Codling Moth.**—*11th Rept. State Entomologist & Plant Pathologist Virginia, 1916–1917*; *Richmond*, 1918, pp. 22–26, 1 fig. [Received 12th March 1919.]

Experimental dusting and spraying against apple scab and codling moth [*Cydia pomonella*] shows that satisfactory results in dealing with the latter pest are obtained by a dusting mixture consisting of sulphur, hydrated lime and lead arsenate, and also by spraying with a lime-sulphur and lead-arsenate solution, but that one of lime-sulphur and nicotine sulphate gave less satisfactory results.

SMULYAN (M. T.). **Observations during 1916 of the Aphids most common on the Apple.**—*11th Rept. State Entomologist & Plant Pathologist Virginia, 1916–1917*; *Richmond*, 1918, pp. 27–39, 1 plate. [Received 12th March 1919.]

These observations on the Aphids most common on the apple during 1916, supplement and confirm those of the previous year [see this *Review*, Ser. A, iv, p. 340].

Dangerous Pests found in European Shipments.—*Wkly. Press Bull. Pennsylvania Dept. Agric., Harrisburg*, iv, no. 9, 6th March 1919.

During the inspection of a consignment of French nursery stock by the inspectors of the Department of Agriculture at the beginning of March, a living caterpillar of the brown-tail moth [*Nygmia phaeorrhoea*] and the eggs of the gipsy-moth [*Porthetria dispar*] were found. These pests are not known to be established in Pennsylvania or the adjacent States, but they have cost the New England states more than £6,000,000 in losses to forests and woodlands and in expenditures for control. On 1st July 1919 the Federal Quarantine restricting plant imports becomes effective and the risk of the introduction of foreign pests will be thereby greatly reduced.

SHERMAN (F.). Report of Division of Entomology.—*40th Ann. Rept. North Carolina Agric. Expt. Sta. for Year ended 30th June 1917, [Raleigh]* [n.d.], pp. 64–66. [Received 18th March 1919.]

Peach spraying experiments during the years 1914–15 showed that commercial lime-sulphur at the rate of 1 gal. to 49 gals. water with lead arsenate added, when persistently used as a summer spray, resulted in final injury to the trees, though this was not evident during the first year, and though it gave a better colour to the fruit than the standard self-boiled lime-sulphur with arsenate. The use of soap as a spreader, or of flour-paste as an adhesive, did not appear to render the lead arsenate more effective against the peach curculio [*Conotrachelus nenuphar*], the injury due to which, based on the counts of prematurely dropping fruit, was greater near woodlands.

METCALF (Z. P.). Report of Entomologist.—*40th Ann. Rept. North Carolina Agric. Expt. Sta. for Year ended 30th June 1917, [Raleigh]* [n.d.], p. 67. [Received 18th March 1919.]

Since reporting on experiments with lime for the control of *Bruchus* spp. (cow-pea weevils) [see this *Review*, Ser. A, v, p. 208], further experiments on a large scale have shown that where cowpeas are stored in large amounts, the lime may simply be spread in a layer on top of the peas and still accomplish the same result.

EHRHORN (E. M.). Division of Plant Inspection.—*Hawaiian Forester & Agriculturist, Honolulu*, xvi, no. 1, January 1919, pp. 13–14.

A nest of an ant, *Monomorium pharaonis*, was intercepted during December on sealing-wax palms from Java; the same species and a scale-insect were found on orchids from the same country. Pots of *Thuya orientalis* from Japan were fumigated owing to the presence of larvae of a Curculionid beetle. Acorns from Japan were also found to be infested with weevils.

FRYER (J. C. F.). Mustard-growing as a Preventive of Wireworm.—*Gardeners' Chronicle, London*, lxv, no. 1676, 8th February 1919, p. 64.

A mustard crop, grown for the purpose of treating land infested with wireworms, may be dealt with in three ways. It may be sown in April and May as a seed crop and will occupy the ground for the whole summer; it may be ploughed in green, usually when about 18 ins. to 2 ft. in height; it may be eaten off by sheep. In the last two cases it is usually sown in late summer, after a fallow or the harvesting of an early crop, the manurial effect being considerable in both cases. Mustard is seldom attacked by wireworms, but when these have absolutely no other food they can for a time eat mustard though they cannot thrive on it, and if there is little else growing on the land during the summer they gradually die out. When the crop is ploughed in, it would almost appear that the plant on decomposition releases some substance definitely injurious to wireworms. When mustard is to be used as a preventive treatment for wireworm, probably the best method is to sow it as a first crop, preferably for seed, in which case it will certainly prevent trouble from such "annual" pests as leather-jackets [*Tipula*].

J. F. **Insects and Fungi on Grass Land.**—*Gardeners' Chronicle, London,* lxv, no. 1680, 8th March 1919, p. 114.

On a piece of grass land broken up for cultivation in 1918, the local insect pests were *Amphimallus* (*Rhizotrogus*) *solstitialis*, *Melolontha melolontha* (*vulgaris*), *Tipula* (leather-jacket), *Feltia* (*Agrotis*) *exclamationis* and *Euxoa* (*A.*) *segetum*, the last two cutworms being most destructive to cabbage, parsley and potatoes. Some other insects were present, but they disappeared with the destruction of their food or shelter and were not injurious to the vegetables.

Imported pests, or those that invaded the new feeding ground were: *Phorbia* (*Anthomyia*) *brassicae* (cabbage fly) imported on seedling cabbages; *Pegomyia hyoscyami* (*A. betae*) on beet, *Hylemyia antiqua* (*A. ceparum*) on onions, and *A. radicum* on radishes; *Acidia heraclei* (celery fly) on parsnips; *Psila rosae* (carrot fly) and *Ceuthorrhynchus sulcicollis* (cabbage gall weevil); *Orgyia antiqua* (vapourer moth) on plane trees; *Aphis rumicis* (black aphis) on broad beans and *Brevicoryne* (*A.*) *brassicae* (cabbage aphis) more or less destructive to cabbages; and *Depressaria discipunctella* (*pastinacella*) injuring parsnip leaves.

Ashley (K.). **The Frog-hopper or Cuckoo-spit.**—*Gardeners' Chronicle, London,* lxv, no. 1681, 15th March 1919, p. 122, 1 fig.

The frog-hopper (*Aphrophora*) causes serious damage to roses during June and July, weakening the young shoots and buds by extracting the sap. Strong tobacco water with a little soft-soap added is considered one of the best remedies for this pest, but great care must be taken in using the soap to prevent scorching of the foliage. Tobacco water without soap made by boiling 4 oz. shag tobacco in 1 gal. water gives good results if the affected shoots are bent over and washed clean in it, an operation than can be effected by having the tobacco water in a tin can with a handle over it slung on the wrist, so as to leave both hands free. The most careful attention, constantly exercised, is necessary to effect control of this pest.

Aulló (M.). **Reseña de los Trabajos verificados por la Comisión de la Fauna forestal española durante el Año de 1916.** [A Review of the Work of the Spanish Forestal Fauna Commission during 1916.] —*Bol. Soc. Entom. España, Saragossa,* ii, nos. 1 & 2, January–February 1919, pp. 19–28 & 46–47.

Further investigations on *Dendrolimus pini*, L. [see this *Review* Ser. A, vii, p. 89] are described. There are two generations of this moth, the adults of the second appearing in September. Hibernation in Spain occurs not on the ground as in other countries, but on the pine trunks, and is not passed in complete inaction, the larvae appearing active on warm days. This is probably accounted for by the warm climate. Natural enemies, although not sufficiently numerous to afford an effective control, exercise a certain check on the numbers of *D. pini*.

The sawfly, *Lophyrus rufus*, Retz., was observed in the larval stage on young pines. The caterpillars of the moth, *Hyloicus* (*Sphinx*) *pinastri*, L., also occurred on pines until November or early December,

when they descended to the ground to pupate. Other pine pests were *Dioryctria (Phycis) silvestrella*, Ratz., a species formerly thought to be *D. (P.) abietella*, Zk., but now identified as *D. mendacella*, Stgr., and the weevil, *Pissodes validirostris*, Gyll. The two last-named have not apparently been recorded before as injuring pines in Spain. *P. validirostris* is generally found in company with *D. mendacella* and occurs only on *Pinus silvestris* As they both reach the adult stage in August and September, and infestation of the cones is noticeable by the latter half of June, the cones should be collected and burnt before the usual time in order to prevent the larvae from descending to the ground to pupate. Both pupae and eggs of *D. mendacella* are difficult to locate, while the adult moth flies only at night, is not attracted to lights, and lives only a very short time. Studies have also been made of *Ips (Bostrichus) sexdentatus*, Boern, and of a Buprestid larva that injures resinous pines. This may be *Ancylocheira (Buprestis) flavomaculata*, F., or possibly *Melanophila tarda*, F., both of which have been found on pines. Pines that were heavily infested with *Pissodes notatus*, F., were destroyed before the insects completed maturity. *Rhyacionia (Evetria) buoliana*, Schiff., also caused considerable damage among pine plantations, as well as another caterpillar, probably of *Tortrix viridana*, L.

Minor pests of forest trees identified include the Coleoptera :—*Acanthocinus aedilis*, L., in pines; *Oberea linearis*, L. (?) in hazel; *Myelophilus piniperda*, L., in pines; *Anthaxia praticola*, Kies., in young, dead pines; *A. manca*, Esch., in elms attacked by *Scolytus multistriatus*; *Chalcophora mariana*, L., in pines; and *Herpysticus eremita*, on fruit-trees. Among Lepidoptera, *Aglaope infausta*, L., and *Malacosoma neustria*, L., occurred on almonds and cork oak; *Porthetria (Lymantria) dispar*, *Tortrix viridana* and *Nygmia phaeorrhoea (Euproctis chrysorrhoea)*, on evergreen and cork oaks; *Phalera bucephala* on hazel; *Stilpnotia (Leucoma) salicis*, L., on black poplar; *Rhyacionia (Tortrix) duplana* on pines; and *Hyponomeuta* sp. on hawthorn.

RORER (J. B.). **Enfermedades y Plagas del Cacao en el Ecuador y Métodos Modernos apropiados al Cultivo del Cacao.** [Diseases and Pests of Cacao in Ecuador and Modern M thods appropriate to the Cultivation of Cacao.]—*Rept. presented to the Agric. Assoc. of Ecuador, Guayaquil*, 24th January 1918, 79 pp., 22 figs. [Received 17th March 1919.]

Among the insect pests of cacao in Ecuador, ants are found in almost all plantations and cause considerable damage by defoliating the trees. The method advocated for their extermination is to close up with earth all but one or two of the holes in a nest and to pour into the remaining openings a mixture of equal parts of carbon bisulphide and gasoline. This is then exploded by means of a light fastened to the end of a long cane and the holes plugged up to prevent the escape of the gases.

A cacao beetle of the genus *Stirastoma* occurs; this is similar to, if not identical with, the species [*S. depressum*] that causes so much damage in the West Indies and other countries. The eggs are laid in the trunks of the trees and the larvae tunnel in the bark, sometimes killing the branch or even the main trunk.

By far the most important enemy of cácao in Ecuador is *Monalonion atratum (dissimulatum)*, known as "mosquilla." The eggs of this Capsid bug are laid in the peduncle or on the outside of the cacao pods, of which the nymphs suck the juices, leaving scars and finally causing the pods to turn black and wither. No food-plant other than cacao has been observed. Remedial measures that have been suggested include gathering and destroying the pods at the season when they are least numerous, and also the burning of the nymphs on the pods by means of an alcohol or kerosene torch; neither of these methods is very satisfactory. The author advocates the use of contact insecticides, such as nicotine sulphate or weak Bordeaux mixture, which have given very good results. Pods covered with this mixture would probably be avoided by the ovipositing insects.

TAKAHASHI (R.). **Three Species of Aphididae.**—*Zool. Mag., Tokio* 1918, pp. 368–376. [Received 17th March 1919.]

The species dealt with in this paper, in Japanese, are *Trichosiphum kuwanae*, Perg., *Stomaphis yanonis*, sp. n., and *Rhopalosiphum sambucicola*, sp. n.

TAKAHASHI (R.). **Description of** *Cervaphis quercus*, sp. n.—*Zool. Mag., Tokio*, xxx, 1918, pp. 458–461, 12 figs. [Received 17th March 1919.]

The oviparous female of *Cervaphis quercus* which closely resembles *C. schouteniae*, v. d. G., is winged and appears in the summer, the food-plant being *Quercus serrata*.

MATSUMURA (S.). **New Species of the Economic Syrphidae of Japan.** —*Jl. Coll. Agric. Hokkaido Imperial Univ., Sapporo*, viii, no. 1, October 1918, 31 pp., 1 plate.

Descriptions are given of 54 new species and 4 new genera of Japanese SYRPHIDAE. Among these, *Mesosyrphus abietis*, sp. n., *Catabomba excavata*, sp. n., and *Eristalosyrphus griseofasciatus*, gen. et sp. n., have been collected on *Abies sachalinensis*, sucking the juices secreted by an Aphid, *Mindarus abietinus*. The habits of the other species are not stated.

ROSS (W. A.). **The Rose Midge in Ontario.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 2, February 1919, pp. 137–138, 1 fig.

The rose midge [*Neocerata rhodophaga*] has been recently introduced into Canada from the United States, where it is the most destructive pest of roses, the annual loss due to it in two Chicago greenhouses amounting to £2,000. The larvae usually attack the young shoots in the axil of a leaf-petiole, such shoots either becoming deformed, or withering and dying. Fortunately the pest hibernates in the soil during the winter when the most profitable crops are grown. The eggs are laid between the folded leaves of the leaf-buds, in the axils of young leaves and between the sepals and petals of flower-buds, and under greenhouse conditions hatch in about 2 days. The larvae, which mature in from 5 to 7 days, pupate in the soil and emerge as

adults in about 6 days. This midge is most abundant and destructive in summer, but declines in numbers at the beginning of autumn and finally disappears by November. It hibernates in the soil and does not reappear again till early March

Total eradication has been experimentally effected by sprinkling tobacco dust over the beds from ¼ inch to ½ inch in thickness to prevent the falling larvae from entering the soil, this treatment being followed by nightly fumigations with tobacco paper, continued as long as any adults were seen. As an additional precaution all the walks were sprayed with a 5 per cent. kerosene emulsion to kill any larvae that might have fallen on to them from the plants. In practice the midge may be held in check by fumigating with nicotine every night as soon as the pest is observed in spring, the treatment to be repeated at any time that it threatens to be troublesome. Infested shoots and buds should be at once pinched off and destroyed. Another method, not yet tested, by which extermination might be effected in a greenhouse, would be by drying off all the rose plants at the same time during the summer, when the insect would die of starvation. Prevention could also be effected by growers propagating their own roses; by obtaining new stock from non-infested houses; by purchasing before the end of February stock planted in November or December, which, therefore, has not been exposed to infection; by washing the root soil from plants obtained later than February, such soil being either burned or scalded with hot water or steam.

ANDERSON (W. B.). **Notes on the Tussock Moth,** ***Hemerocampa vetusta gulosa*****, Hy. Edw., in British Columbia.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 2, February 1919, p. 139.

The larvae of *Hemerocampa vetusta gulosa* were found in August 1918 attacking Douglas firs over an area of about ⅛ square mile on the Thompson River, British Columbia, and many pupae taken at that time were found to be parasitised. The yellow pine (*Pinus ponderosa*) is also attacked, but much more sparingly. The attack begins at the top of the tree and works downwards, the entire tree being usually defoliated and killed outright, no later growth occurring as is the case after defoliation by *Tortrix* (*Harmologa*) *fumiferana* (spruce budworm).

CAESAR (L.) & ROSS (W. A.). **Control of the Apple Maggot.**—*Canadian Horticulturist, Toronto*, xlii, no. 2, February 1919, pp. 27–28.

The results of field tests conducted in various parts of Ontario and spread over 5 consecutive years and corroborated by laboratory tests justify the confident belief that the apple maggot [*Rhagoletis pomonella*] can be successfully controlled in apple orchards by spraying. The first application should be given just before or as the adults begin to emerge, the date varying with the climate of the locality from the last week in June to the second week in July. The second application should be made when the result of the first is beginning to disappear, usually in from 2–3 weeks. In wet seasons a third

application about 10 days after the second will be necessary. In two years the insect should be almost completely destroyed in any orchard, provided that infested orchards are not situated close by, in which case efforts should be made to treat these also. In all orchards every tree, whether fruit-bearing or not, should be sprayed.

The best spray mixture consists of 2 to 3 lb. lead arsenate paste, or 1 to 1½ lb. lead arsenate powder to 40 gals. water, its effectiveness not being increased by the addition of molasses, which adds to the cost, causes the spray to wash off more quickly and sometimes scorches the foliage. Heavy rather than light applications of the mixture should be made, especially if only two are given, because they remain on longer, and since adults continue to emerge for a period of 6 weeks or more, the poison must remain on the trees to kill them before they can oviposit.

Progress in the Chief Industries. Cotton.—*Rept. Agric. Dept. St. Vincent, 1917–1918*; *Barbados*, 1919, pp. 15–19. [Received 18th March 1919.]

The measures adopted by the Agricultural Department for the control of the cotton stainer, *Dysdercus delauneyi*, together with a prospect of high prices for cotton, led planters to make a further extended trial and to plant an increased acreage in 1917–18. In St. Vincent success attended their efforts at control and the yield per acre exceeded the average of the previous 13 years. Under local conditions the practice of pulling up and burning the old cotton stalks at the end of each season has had the effect of relegating the leaf-blister mite, *Eriophyes gossypii*, to the position of a very minor pest, and recent experiments show that the stalks, if dealt with promptly, can be used as traps for cotton stainers.

An important Order-in-Council was published on 25th July under the Importation of Plant Diseases Prevention Ordinance (1906), prohibiting the importation of cotton seed and seed cotton into the Colony from any outside source. Though primarily intended to prevent the introduction of the Mexican boll weevil [*Anthonomus grandis*] and pink bollworm [*Pectinophora gossypiella*], it also aimed at the exclusion of certain pests and diseases occurring in other parts of the West Indies, but not found locally.

NEWELL (W.). **Report of the Plant Commissioner for the Biennium ending April 30th, 1918, and Supplemental Reports.**—*Qtrly. Bull. Florida State Plant Board, Gainesville*, iii, no. 2, January 1919, pp. 33–108.

During the two years ended April 1918, the Florida State Plant Board, in accordance with the Florida Plant Act of 1915, has been able to maintain a successful barrier against the entrance of the black fly of citrus [*Aleurocanthus woglumi*], a most serious pest occurring in Cuba, Jamaica, the Bahamas and the Canal Zone. Nursery inspection resulted in the San José scale [*Aspidiotus perniciosus*] being found on 110 occasions. Camphor thrips [*Cryptothrips floridensis*] was found in 10 nurseries and suitably dealt with, and the banana root-borer [*Cosmopolites sordidus*] being found in one, all banana plants in this and adjacent properties were promptly destroyed.

The Port and Railway Inspection Department has during the above period examined 6,527 shipments, more than one-half of which were found to be infested with injurious insects. Interceptions of particular importance were those of the black fly on two occasions, the sweet potato scarabee [*Euscepes batatae*] from the British West Indies, the sweet potato weevil [*Cylas formicarius*] in many West Indian shipments, and a new mango disease and mango leaf-infesting insect from India, while in many instances scale-insects which are rare or not present in Florida were prevented from entering.

Parcel Post Inspection, begun on 1st November 1916, resulted in 9,183 parcels being inspected, of which 845 were non-deliverable, while 292 were treated and passed.

The sweet potato weevil [*Cylas formicarius*] [see this *Review*, Ser. A, vii, p. 21] is a pest that threatens to destroy the sweet potato growing industry of Florida, as well as the supplying of many millions of sweet potato plants to the growers of other States, a business which brings into Florida annually a sum of between £15,000 and £20,000. Remedial measures advocated are:—Field rotation in planting, use of weevil-free plants, elimination of "hold-over" planting, destruction of morning-glory vines as far as practicable, thoroughness in harvesting, fumigation of harvested tubers, destruction of badly infested tubers, prevention of weevil damage in storage, destruction of self-sown plants in spring, and the avoidance of very early planting, together with the strict enforcement of the quarantine rules to prevent the further spread of the pest. This weevil has recently been found infesting two species of morning glory not hitherto known to be attacked by it in Florida, viz.:—*Ipomoea pandurata*, growing on high sandy land, and *I. littoralis*, growing along the sea-coast.

The banana root borer (*Cosmopolites sordidus*) was first discovered in Florida in December 1917, and its control by means of the careful inspection of banana plantations, followed by the uprooting and burning of all infested banana plants and the trapping of any escaping weevils is being vigorously prosecuted, since the insect also attacks sugar-cane and its future presence in the State might seriously interfere with the development of a large sugar and syrup producing industry.

The area in Florida infested by the cotton boll-weevil [*Anthonomus grandis*] has gradually increased southward and eastward owing to the migration of the adults by flight, a spread that cannot be prevented and that results in the insect invading new territory each year. The enforcement of quarantine measures, however, which prohibit the removal from weevil-infested territory of cotton seed, seed cotton, bolls, Spanish moss, maize in the cob and certain other materials, except at certain seasons and under certain conditions, has undoubtedly prevented the establishment of the pest ahead of the advancing line of migration.

It is essential that the quarantine measures now in force for the exclusion of the pink bollworm [*Pectinophora gossypiella*] from Florida should be continued, since it is not yet certain that the Texas outbreaks will be eradicated [see this *Review*, Ser. A, vi, p. 544].

The enforcement is still continued of the various quarantine measures to prevent the introduction into Florida of the avocado weevil [*Heilipus lauri*], gipsy moth [*Porthetria dispar*], brown-tail moth [*Nygmia phaeorrhoea*], Mediterranean fruit fly [*Ceratitis capitata*], Mexican

orange maggot [*Trypeta ludens*], pineapple black weevil [*Metamasius ritchiei*], West Indian sweet potato weevil [*Euscepes batatae*], mango seed weevil [*Sternochetus mangiferae*] and Argentine ant [*Iridomyrmex humilis*].

The Department of Entomology during the two years under review has prepared and sold 1,085 pure cultures of the red fungus [*Aschersonia aleurodis*] which attacks the larvae of the citrus white fly [*Dialeurodes citri*], and has also distributed a considerable number of cultures of the yellow fungus [*A. flavocitrina*] for the control of the cloudy-winged whitefly [*Aleurodes nubifera*]. Numerous colonies of the Australian Coccinellid [*Novius cardinalis*] for the control of the cottony cushion-scale [*Icerya purchasi*] were reared and distributed. It was found that, within certain limits, *N. cardinalis* can be reared in the laboratory by feeding it on *I. purchasi*, large supplies of which must be collected and kept in cold storage for the purpose. It was also found that, in the temporary absence of these scale-insects, the young beetles can themselves be placed in cold storage and their development arrested pending the arrival of further consignments of food. A method consisting of cutting back and treating trees infested with camphor thrips [*Cryptothrips floridensis*], which renders them free from infestation, has been adopted.

MONTGOMERY (J. H.) & BRAGDON (K. E.). **Quarantine Department.** —*Qtrly. Bull. Florida State Plant Board, Gainesville*, iii, no. 2, January 1919, pp. 110–112.

During the quarter ending 31st December 1918, the principal pests intercepted from foreign countries included:—*Aspidiotus* sp. on cassava, *A. cocotiphagus* on coconut, bollworm [*Heliothis obsoleta*] on maize, cigarette beetle [*Lasioderma serricorne*] on cassava, sweet potato weevil [*Cylas formicarius*] in sweet potato from Cuba, and sweet potato scarabee [*Euscepes batatae*] in sweet potato from Porto Rico.

WEISS (H. B.). **Unusual Nursery Insects.**—*New Jersey Dept. Agric. Bur. Statistics & Inspection, Trenton*, Circ. no. 24, November 1918, 13 pp., 6 figs. [Received 19th March 1919.]

Agromyza laterella, Zett. (iris leaf-miner) has been injurious to Japanese iris for several years in New Jersey nurseries. The larvae mine in the leaves, beginning near the surface of the soil and extending upwards for 10 to 16 inches, and also mine the part of the plant just below the surface, marring the appearance, but not involving the death of the plant. The flies appear early in June and oviposit at the base of the plants under the epidermis of the leaf. The incubation period is about 15 days and the larvae after tunnelling upwards pupate at the ends of their mines, the adults emerging during the latter part of August in South Jersey, where a second brood occurs; hibernation takes place in the pupal stage within the mines. Remedial measures consist in destroying the larvae in their mines by spraying with an 8 per cent. kerosene emulsion, or with Black Leaf 40 at the

rate of 1 U.S. pint to 100 U.S. gals. water to which 5 lb. soap has been added. Cutting the foliage close to the ground in winter and burning it has also been suggested as a means of destroying overwintering pupae. Up to the present this miner has been found only in *Iris kaempferi.*

Agrilus sinuatus, Oliv. (sinuate pear borer) is a European insect, the life-cycle of which occupies two years and which was first discovered in New Jersey in 1894 [see this *Review*, Ser. A, iv, p. 273].

Idiocerus cognatus, Fieb. (white poplar leaf-hopper) has been found at several places in New Jersey since 1917 on white poplar (*Populus alba*) in nurseries, having probably been introduced in the egg-stage with this tree. The eggs are deposited during the latter part of July, usually in the terminal twigs ; hence all the new wood is likely to contain eggs, and these are most plentiful in the last foot of the twig and less so towards the base and extreme tip. Hibernation takes place in the egg-stage and the nymphs emerge from the middle to the end of May, making their way at once to the unfolding tender leaves at the tips of the twigs. There are 5 nymphal stages, each occupying from 3 to 6 days, the bulk of the adults appearing during the end of June and beginning of July. There is only one generation a year, the adults being found in diminishing numbers throughout August till October. The presence of many nymphs on the young leaves causes a certain amount of injury by malformation.

A Chrysomelid beetle, *Zeugophora scutellaris*, Suffr. (poplar leaf-miner), occurs in Central Europe and is also present in several localities in the United States, but never in numbers considered injurious. The adult beetle feeds on the foliage of poplar (*Populus deltoides*) and the larvae mine in the leaves. The adults, which appear in June, feed on the terminal leaves, skeletonising them from the lower surface. Eggs are deposited on the leaves and the larvae mine the tissue during July, each mine usually containing one larva, though there may be as many as four. By the first week in August they are mature and drop to the soil to pupate. Spraying with lead arsenate while the beetles are feeding is recommended as a remedial measure, care being taken to coat the lower leaf surfaces.

Eumerus strigatus, Fall. (lunate onion fly) was first definitely recorded from New Jersey during the spring of 1918, having evidently been introduced in bulbs from Holland, where this Syrphid is a pest of narcissus, hyacinth and onion, especially the first. The flies appear in May and June flying low on bright sunny days, and they may be captured on the flowers of various plants. Eggs are laid on the bases of the leaves and the larvae enter the nose of the bulb, sometimes to the number of from 10 to 30, and feed in the interior, which soon becomes decayed. Pupation takes place in the outside layers or at the nose of the bulb during August, and a second brood of flies, of which little is known, apparently occurs in September and October. In Holland, the destruction of infested bulbs seems to be the usual remedial measure.

Calophya nigripennis, Riley (sumac Psyllid) is not seriously injurious, but should control be necessary, the application of tobacco extract and soap is suggested, care being taken to reach both leaf surfaces and the woody stems [see this *Review*, Ser. A, vii, p. 119].

PAILLOT (A.). **Coccobacilles nouveaux Parasites du Hanneton.** [New parasitic Coccobacilli of the Cockchafer.]—*C.R. hebdom. Acad. Sci., Paris*, clxvii, no. 26, 23rd December 1918, pp. 1046–1048.

In the Lyons region in 1916, 3 coccobacilli and 3 other microbes had been isolated from diseased cockchafers [*Melolontha melolontha*] [see this *Review*, Ser. A, v, p. 161], and in the following year 3 other coccobacilli, quite different from these, were isolated from the same insect in Touraine, and were named *Bacillus melolonthae liquefasciens* β & γ and *B. melolonthae nonliquefasciens* δ. Observations made in 1917 afford a proof of the multiplicity of epidemic maladies capable of checking the increase of the cockchafer. The same conclusions may be drawn from similar studies on other insects such as *Porthetria dispar, Pieris brassicae*, and silkworms [*Bombyx mori*], it being a fact that the microbic flora of insects is not surpassed in richness and variety by that of vertebrates.

The most wide-spread form of infection is septicaemia, but the microbes of insects have never exhibited a specificity for the tissues of the host as great as that of certain parasites of man, such as the meningococcus or gonococcus.

PAILLOT (A.). **La Pseudograsserie, Maladie nouvelle des Chenilles de** *Lymantria dispar*.—*C.R. hebdom. Acad. Sci., Paris*, clxviii, no. 4, 27th January 1919, pp. 258–260.

A larva of *Porthetria* (*Lymantria*) *dispar* which exhibited the external symptoms of grasserie and of flacherie was found to be infected with two coccobacilli, one of which alone caused the disease here dealt with. An emulsion of the bacilli, obtained from a pure culture, produced the disease in its typical form. A few hours after inoculation the blood presented the same milky appearance as that of larvae attacked by grasserie, but it was clouded with globules of oil instead of the polyhedral bodies of an unknown nature characteristic of true grasserie.

The inoculation of the microbe into the larvae of *Vanessa urticae, Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*) and silkworms [*Bombyx mori*] reproduced the symptoms observed in the larvae of *Porthetria dispar*; hence the new disease is named "pseudograsserie." In 1918, no new case was observed owing to the rarity of epidemic diseases due to the extreme dryness of the season.

PAILLOT (A.). **Coccobacilles Parasites des Chenilles de** *Pieris brassicae*. —*C. R. hebdom. Acad. Sci., Paris*, clxviii, no. 9, 3rd March 1919, pp. 476–478.

This paper deals with five coccobacilli, four from the region of Lyons and the fifth from the Jura, obtained from the larvae of *Pieris brassicae*.

TIJMSTRA Bz. (S.). **Schweinfurter Groen.** [Paris Green.]—*Bull. Deli Proefstation, Medan*, no. 11, December 1918, pp. 1–7.

Paris green used as an insecticide is apt to scorch the foliage of plants owing to the presence of soluble arsenious acid, but the amount of injury caused by it is not proportional to the amount of arsenious

acid, at least in the case of tobacco in Deli. Insufficient mixing with the diluent or unfavourable weather may account for this. To ascertain the content of water-soluble arsenious acid 5 grms. of the powder were placed in a 500 c.c. retort which was filled to the mark with distilled water free from carbonic acid. The retort was rotated for 1, 5, 25 and 125 hours at a temperature of 30° C. [86° F.] and the amount of arsenious acid was then determined by titrating 100 c.c. of the filtrate. It was found that whereas the percentage of arsenious acid was 0·63 after 1 hour's rotation it increased to 8·49 after 125 hours. Tests with various samples of Paris green showed that some of them parted with the acid more readily than others and that these are the ones more likely to scorch. The American method of boiling Paris green in a solution of sodium acetate also yielded more arsenious acid if the time was increased. In judging the quality of Paris green it must therefore be remembered that the duration of the treatment influences both the absolute and the relative result, and besides ascertaining the amount of arsenious acid after 1 hour, it is necessary to note the results after 2, 4, 6 and more hours.

SILVESTRI (F.). **Il Ceroplaste (o Cocciniglia) cinese degli Agrumi.** [The Citrus Scale, *Ceroplastes sinensis*.]—*R. Lab. Entom. Agraria, Portici*, Boll. no. 2, 10th February 1919, 15 pp., 6 figs.

About twenty years ago *Ceroplastes sinensis* was added to the list of scale-insects infesting citrus trees in Italy and Sicily, having been introduced a few years previously. A description is given of the larva and adult. At Portici oviposition takes place from early July to early August; the young larvae begin to appear in the second fortnight of July and some are still to be seen at the end of August. The difference between the sexes becomes apparent in the third stage larvae. Some of the males pupate at the end of October and yield adults in November, while others enter the pupal and adult stages at the end of winter or early in spring. Most of the female larvae moult in late autumn and become definite females of the fourth stage. Larval development is retarded in exposed situations and accelerated in sheltered, warm positions. Thus, first-stage larvae may be found early in winter or definite females may appear early in autumn. The food-plant also influences development. It is advanced one stage on *Schinus molle* and *Veronica speciosa* as compared with development on citrus. *C. sinensis* has therefore one generation a year near Portici. The more preferred food-plants are *Schinus molle*, *Muhlenbeckia platyclados*, *Veronica speciosa*, *V. salicifolia*, *Chrysanthemum frutescens*, *C. grandiflora*, followed by the different kinds of citrus, *Euonymus japonica*, *Spiraea chamaedryfolia*, *Phyladelphus coronaria*, *Aster formosissima*, *Dahlia variabilis* and *Salvia splendens*. *Gardenia florida*, *Amarantus* sp., rose, pear and apple have also been recorded as food-plants, but it is probable that such infestations are accidental and possibly are limited to the first-stage larvae, which may also be found on many herbaceous plants near infested trees. From July to November it is therefore advisable to avoid transferring kitchen-garden and ornamental plants from infested localities to areas that are uninfested. Like other Coccids, *C. sinensis* weakens the plant by sucking its juices and its sugary excreta also favour the growth of sooty fungus.

Natural enemies include a species of *Scutellista*, which parasitises a small proportion of the eggs, and the larvae of the Coccinellids, *Chilocorus* and *Exochomus*, which attack those of the scale. Artificial control should be carried out with a calcium polysulphide spray against the newly-hatched Coccid larvae. A useful formula is: stone quicklime 10 lb., sulphur passed through a sieve 20 lb., water 13 gals. Directions are given for preparing this solution. The use of a polysulphide meter is advisable and Martelli's pattern is figured. The spray may be rendered more adhesive by adding 1 lb. of flour, mixed to a paste and boiled, to every 20 gallons of spray. The cost of spraying is much less than the loss it prevents.

The Conservation of our Cereal Reserves.—*Nature, London*, ciii, no. 2577, 20th March 1919, pp. 55–56.

In a recent lecture by Prof. A. Dendy it is pointed out that grain stored under ordinary conditions is exposed (1) to the attacks of mice and rats, (2) to those of insects and mites, (3) to those of moulds and bacteria, and (4) to the process known as "heating."

The chief insect pests in Britain are the two grain weevils, *Calandra granaria* and *C. oryzae*, while in India two other beetles, *Rhizopertha dominica* and *Trogoderma khapra*, are also responsible for much direct injury. At suitable temperatures the weevils breed all the year round, but in Britain normally only in the warmer months. At about 28° C. (82·4° F.) a single pair of rice-weevils increased about 700-fold in 4 months. The accumulated excrement of the weevils attracts moisture and promotes decomposition accompanied by the evolution of large quantities of ammonia, and in this way the destruction begun by the ravages of the insects is completed.

Airtight storage is an effectual means of preventing damage from all these sources, though considerable doubt has been cast on the efficacy of this method by the belief, based on inaccurate observations, that the weevil is able to withstand such treatment. Experiment, however, proves that all insects are more or less rapidly destroyed when weevilly wheat is sealed up in airtight receptacles which it nearly fills. This treatment destroys weevils in all their stages and is fatal to adult mites, while it also prevents the growth of moulds, and the process of heating [see this *Review*, Ser. A, vii, p. 24].

It has also been demonstrated experimentally that weevils require an abundant supply of oxygen, and also that carbon dioxide, if present in sufficient quantity, has a directly poisonous action upon them. In pure, moist carbon dioxide they become motionless in 3 minutes and can remain in this condition for as much as 4 days (at room temperature) without losing the power of recovery. A mixture of carbon dioxide with 20 per cent. of oxygen is far more fatal than pure carbon dioxide. In a mixture of 56·4 per cent. nitrogen, 20·36 per cent. oxygen and 23·22 per cent. carbon dioxide, weevils became motionless in 43 hours at about 30° C. (86° F.), and after 91 hours' exposure, though 19·09 per cent. of oxygen remained, none revived when supplied with ordinary air.

When wheat is sealed up in a normal atmosphere carbon dioxide accumulates naturally owing to the so-called respiration of the grain,

the accumulation being more rapid if insects are present owing to the large amount which they themselves give off. Thus in hermetically sealed granaries there should be no need for the addition of carbon dioxide, and under proper conditions grain should be self-protective as regards weevils, mildew and heating.

BALL (E. D.). **Economic Entomology: Its Foundations and Future.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 24–35 & 49–58.

The rapid development of economic entomology in America is reviewed, the spread of San José scale [*Aspidiotus perniciosus*] and the consequent establishment of nursery inspection laws being among the causes of the prominence given to the science in recent years. The author questions, however, whether entomologists have completely solved the problem and mastered the intricate relations of a single injurious insect, or whether they have not merely obtained a superficial knowledge of thousands of species. Very many problems remain still unsolved and these involve inter-relations with many allied sciences. It is suggested that a broader fundamental grounding in the related sciences should be required as a basis on which to start entomological training. The tendency towards narrowness and specialisation is deprecated, but it is suggested that group specialisation should be encouraged, after a broad fundamental training. Criticism, constructive criticism if possible, should be welcomed and errors that are known to be such by many workers, and that are still current in entomological literature, should be rectified. With regard to publications, a committee might with advantage formulate rules and regulations to which economic publications should conform. Thus original matter could at once be recognised from popular compilations, while in summaries and reviews every worker would be specifically credited with his contribution. Catalogues, bibliographies, indices and summaries of entomological literature are urgently needed.

There are many fundamental questions involving the effect of insect attack upon the food-plant that offer an extremely important and interesting field, as yet almost untouched. Co-operation with plant pathologists and physiologists in the study of these problems should be most cordial and mutually helpful.

Some of the notable achievements in economic entomology are instanced, both in the realm of crop production and protection, and in the field of medical entomology. It is pointed out that concerted effort and thorough organisation should be capable of eliminating almost any pest in a single season. The warble fly [*Hypoderma*] would hardly have been exterminated before the gain in leather and increased production would have paid the cost. The codling moth [*Cydia pomonella*], which depends on the apple and one or two allied fruits and nuts for existence, could be eliminated from an entire region in a single year by taking advantage of short crops, by reason of frost or previous heavy bearing, and a rigid quarantine could be maintained until adjacent regions had received similar treatment. The cotton-boll weevil [*Anthonomus grandis*] depends entirely upon the cotton plant for its existence, and if the Americans would store cotton in advance and cease to grow the crop for a single year, its

eradication might be accomplished. Economic entomologists are weak in agressive organisation to meet the conditions of the present time. A permanent executive committee should decide upon the problems to be attacked, the method of operation and the organisation of public support and co-operation essential to success.

In the discussion following the reading of this paper, the suggestion regarding the establishment of an executive committee was strongly supported and it was finally resolved that a committee on policy should be appointed having as its functions the directing of all policies of the American Association of Economic Entomologists, and its various undertakings, the formulation and fostering of great entomological policies for the profession and the working out of a more perfect co-ordination of scientific effort among entomologists and between entomologists and other professions.

A correction was made in the statement that the cotton boll-weevil has only one food-plant, a native wild plant found in the mountains from Guatemala to Arizona also serving as a host, while some of the native plants of the South also serve to a limited extent as food-plants. It is possible therefore that this pest might survive in spite of a suspension of cotton growing.

GOSSARD (H. A.) & PARKS (T. H.). **The Ohio Wheat Survey.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 58–66.

For the last two seasons a State-wide survey of wheat infestation has been made in Ohio, with the object of guiding growers to decide whether wheat growing would be advantageous and when sowing could most profitably be done. Some of the results of this survey have already been noticed [see this *Review*, Ser. A, vi, p. 455]. The present paper gives a general account of the plan of these surveys, the cost in each season and the results obtained. In consequence the hopeful outlook of the surveyors regarding the 1919 crop, increased acreage was sown with wheat in the autumn of 1918, in spite of the unusual shortage of labour. As a result of the two surveys, definite knowledge was obtained regarding the distribution of wheat pests, and instructions were issued with regard to minimising the probable damage. The date for wheat sowing and cultural and fertiliser practices were recommended on the basis of the surveyors' reports, and the information was widely disseminated. It is thought possible that a series of annual surveys might result in the solution of many far-reaching problems, some of which are enumerated, and it is questioned how far these points might be elucidated by the survey methods, or what other data are required to obtain the desired solution.

CHAPMAN (R. N.). **Insects in Relation to Wheat Flour and Wheat Flour Substitutes.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 66–70.

When wheat flour substitutes began to be used with wheat flour, wholesale grocers and bakers very soon began to ask for help in protecting their stocks from insects. An enquiry was then undertaken to devise methods of protection and also to study the ecological relations of insects and the various flours and cereals. The consumers

were the worst sufferers, as the millers and dealers, by means of rapid handling, disposed of their products before the eggs could develop. Housekeepers were therefore advised to heat all their substitutes as soon as they were brought into the home, in order to kill any eggs or larvae that might be present. It was found that when the cereal was less than two inches deep in pans and was heated slowly until the surface temperature reached 85° C. (185° F.), the source of heat could then be turned off and in the course of half an hour the heat would diffuse until all parts of the cereal had passed well above the temperature fatal to insects. If the temperature is allowed to rise above 90° C. (194° F.) the cereal will be injured. A mixture of carnauba wax and paraffin has been devised which serves an an indicator [see this *Review*, Ser. A, vi, p. 434]. Cleanliness in handling the flour has undoubtedly reduced infestation, while the exchange or refilling of used sacks has been the source of much trouble. If empty sacks be placed in an oven, three or four deep on boards, and left for five minutes, all insects are killed at the usual temperature of 232° C. By heating all utensils in the oven infested bakeries have been entirely freed from insects.

A study has been made of the relative susceptibility of various flours and cereals; the relations of *Tribolium confusum* to five grades of wheat flour and various wheat flour substitutes being investigated. The results showed no percentages of infestation constant enough to denote decided choice, so long as the coarseness remained about equal in all cereals; but when bran from rye meal was introduced a decided preference for this medium was shown. The element of flakiness was found to be the dominant factor in choice, rather than nutritive differences. In the case of both bran and sawdust, a far higher percentage of beetles chose the coarse rather than the finely ground variety of the same material.

In the study of the relative development of the insects in the various wheat flours and substitutes it was found that the larval life might be prolonged in certain wheat flour substitutes and that this prolongation took place in the last larval instar. In some cases the life-cycle was twice as long as in others. The factor of relative development must, however, await further investigation before its importance in influencing susceptibility can be judged.

BRITTON (W. E.) & ZAPPE (M. P.). **Kerosene Emulsion *versus* Nicotine Solution for Combating the Potato Aphid.**—*Jl. Econ. Entom., Concord., N.H.*, xii, no. 1, February 1919, pp. 71–81.

A heavy infestation of *Macrosiphum solanifolii*, Ashm. (potato aphis) in Connecticut in 1917 necessitated vigorous methods of control, and in early July potato fields were sprayed with Bordeaux mixture, lead arsenate and Black-Leaf 40 at the rate of ½ pint to 50 gallons of the mixture. The spray was not very effective as the waxy nature of the Aphids caused it to roll away in drops. Experiments were therefore tried with various materials to act as spreaders, but nothing seemed to be a successful substitute for soap, which is considered likely to cause injury when used in the combination mixture. The demand for nicotine sulphate became so great that supplies were used up, and kerosene emulsion was then tried against

the Aphids. About 30 oz. of laundry soap were dissolved in 2 U.S. gals. of hot water, and 4 U.S. gals. of kerosene were then thoroughly churned with the solution, the mixture being finally diluted to make 50 U.S. gals. This emulsion was effective, all Aphids hit by the spray being killed. In some cases slight injury was noticed after application of the spray, but this might equally have been caused by mosaic disease that was present on some of the plants. Press notices were then issued to growers recommending this form of spray, which is obtainable at half the cost of nicotine solution, though a little more trouble is necessary in its preparation.

In the course of the discussion following the reading of this paper it was reported that in Ohio washing powder had been used in the place of soap with equally good results, thus obviating the necessity of heat to dissolve the soap. It was pointed out that the main function of soap is as a carrier, and that the alkali itself, or a washing powder, will serve admirably as a softener, provided that it is strong enough to function properly and not strong enough to injure the plant. The preference for using soap is due to the wider margin of safety, while with washing powder the brand used would have to differ with the character of the water used. Entomologists in recommending remedial measures are inclined to be insufficiently considerate towards the farmer's attitude in respect of such items as labour, mechanics, etc. The problem of Aphid control largely resolves itself into a question of thoroughness of application in proportion to strength of spray used, a low nicotine content killing the Aphids if thoroughly covered with it, while much greater strength is required if the insects are not thoroughly wetted. The combination of soap with arsenates is now considered safe by many growers, perhaps owing to the arsenates being better standardised than formerly.

CORY (E. N.). **The Status of the Oriental Peach Moth.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 81–84.

Cydia (*Laspeyresia*) *molesta* (Oriental peach moth) has become so thoroughly established in several of the States on the eastern coast, and the progress of infestation is such that it is feared the pest may finally become as destructive to peaches as the codling-moth [*Cydia pomonella*] is to apples. The percentage of infestation is still, however, quite small, being generally less than five, and may be still further reduced by spraying. Dry particles of self-boiled lime-sulphur will kill newly-hatched larvae that attempt to crawl through them. Dusting may therefore give better control than spraying.

Parasitism probably exercises a large measure of control. About 60 per cent. of the eggs are parasitised by *Trichogramma minutum*, Riley, while seven other parasites destroy about 50 per cent. of the larvae and pupae, four being Hymenoptera and three Diptera.

Experiments for controlling this moth have given very variable results, and depend not only on the actual value of spray applications, but also on the quantity of arsenical spray that a peach tree will stand. Experiments with insecticides on the eggs show that nicotine sulphate 1 : 500 or 1 : 800 gives about 70 per cent. mortality, and calcium arsenate and calcium caseinate, in combination with self-boiled lime-sulphur,

are equally effective in laboratory tests. Field tests showed even better results. Apparently prompt treatment with a suitable insecticide will control the pest, but the question of economy in spraying and the possible results to the tree will need thorough investigation. A serious problem is the attack on apples by the late broods; this seems to afford one of the principal means of survival of the over-wintering individuals, at least in young trees adjacent to apple orchards. So long as fruit is not placed under quarantine, the spread of infestation cannot be checked, for infested fruit is a greater danger than nursery stock. While the pest conforms to its present habits, however, no great danger from it is feared.

In the course of the discussion following the paper it was stated that the localities in the eastern States in which the pest occurs have been determined by inspection. The same type of injury found in many other localities is attributable to *Anarsia lineatella*. Attention is drawn to the difference in injury to peach twigs by *C. molesta* and the tarnished plant bug [*Lygus pratensis*], the twigs attacked by the former insect being always hollowed out.

SANDERS (J. G.). **An European Scale Insect becoming a Menace in Pennsylvania.** — *Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 90–91, 1 fig.

The scale-insect, *Eulecanium* (*Lecanium*) *prunastri*, Boy., which is probably a native of China, has recently become established in Pennsylvania in rather widely-scattered localities. Its principal food-plants are peach, sweet cherry and apricot, and the damage it does is sufficiently serious to cause alarm to fruit-growers. Some branches of peach have become so thickly covered with the scale that they become dwarfed and eventually die. In orchards where the customary winter dormant spray with lime-sulphur is given, the scale has not assumed dangerous proportions. On a specimen of plum from China, *L. prunastri* was found associated with *Aulacaspis* (*Diaspis*) *pentagona*.

CAFFREY (D. J.). **The European Corn Borer Problem.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 92–105.

Pyrausta nubilalis, Hbn. (European corn borer) was first discovered in Massachusetts in July 1917 [see this *Review*, Ser. A, vi, pp. 373, 554], and then occurred in an area of approximately 100 square miles, while it is now present over about 320 square miles. It is believed that this is one of the most serious plant pests that has yet been introduced into the United States, and its menace to the maize-growing industry in such States as Kansas, Illinois, Ohio, Indiana, etc., constitutes a serious problem of national importance. Food-plants in Massachusetts are sweet, field and fodder maize, celery, beans, potatoes, Swiss chard, beets, spinach, dahlias, gladiolus, chrysanthemums and several of the larger weeds and grasses. Although maize is the preferred food, the variety of other host-plants has enabled the pest to become established throughout the infested area and greatly complicates the problem of control and of preventing further spread. *P. nubilalis* passes the winter as a full-grown or nearly full-grown caterpillar within tunnels in the host-plant. It resumes feeding in the warm weather of April or May and pupates about the middle of May within

the larval tunnels. The moths emerge at the beginning of June, and eggs are deposited generally on the lower surface of the foliage of the host-plant, in masses of from 5 to 50, the average number being 350 for each female. When maize is attacked, the larvae feed first upon the epidermis of the leaf-blades and then enter the stalk and tunnel through all parts of the plant except the fibrous roots. This weakens the plant and retards development of the ear, while in many cases proper fertilisation is prevented. The kernels and cob are also frequently tunnelled, and as many as 15 larvae have been found feeding in a single ear of maize. Badly infested fields have averaged as many as 1,050,000 larvae per acre. The caterpillars of this generation pupate within the host-plant about mid-July and the resulting moths oviposit on late maize or other wild or cultivated plants. The larvae of the second generation are particularly injurious to the ears of maize, and they feed until hibernation occurs in November or December.

The chief danger of the dissemination of *P. nubilalis* is through the transportation of maize and its products. Dry stalks of maize, for example, are frequently used as packing material, and as the hibernating larvae remain dormant in the stalks from December to May, and can survive almost any extremes of cold, heat or drought, they may be in quite a healthy condition after being carried for considerable distances. In order to obviate these dangers, a quarantine order was issued, and became effective on 1st October 1918, prohibiting inter-State movements of maize fodder or stalks, whether for packing or otherwise, green sweet maize, roasting ears and maize cobs from the towns within the area infested by the European corn borer. As, however, there are many other food materials that serve as hosts for *P. nubilalis*, this quarantine will not entirely restrict the spread of the insect, as the other plants and vegetables on which it feeds may equally be included in consignments to points outside the infested area.

It is obvious that any measures aiming at the control of the pest and its limitation to its present area must consist of the destruction of the infested plants within that area, supplemented by quarantine measures against the transportation of infested material. It is hoped by these means that the pest may be prevented from reaching the great maize belt that constitutes the most valuable crop of the country.

In discussing the details of remedial measures, it is stated that when a good fire is started over an area where the plants are dry, all parts of the plants can be destroyed, but when the maize or weeds are more or less green, sufficiently thorough burning to destroy the larvae is very difficult to effect. Pulling up the plants and burning them in a mass has been tried with much the same results. A kerosene torch was useful in this connection if the plants were fairly dry. Another method was to soak the mass of vegetation and the ground surface with kerosene combined with a cheap lubricating oil known as black oil, and this ensured the thorough burning of the vegetation.

In the course of the discussion following this paper, the urgency of a prompt campaign against *P. nubilalis* was emphasised; the gipsy moth [*Porthetria dispar*] and the boll weevil [*Anthonomus grandis*] were quoted as instances where control measures had been

delayed too long with disastrous results. A motion was carried endorsing extreme measures for the eradication of the European corn borer, and asking Congress for sufficient appropriation to undertake immediately a competent campaign of eradication under Federal direction.*

BURKE (H. E.). **Biological Notes on some Flatheaded Bark-borers of the Genus** *Melanophila*.—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 105–108.

This paper supplements previous articles on flatheaded borers [see this *Review*, Ser. A, v, pp. 166, 407 and vi, p. 421], and deals with several species of the genus *Melanophila*. Generally there is one generation in a year. Adult beetles emerging from the trees in the spring and summer of one year lay eggs that hatch into larvae which live through the winter and pupate, emerging as adults in the spring or summer of the following year. Sometimes, however, a number of larvae of one generation will remain in the pupal cells for several years before pupating. The larvae of these beetles mine the inner bark and outer wood and pupate there, the eggs being laid in the crevices of the bark. The adults usually feed on the bark or foliage of the host-trees, but *M. consputa* has been observed devouring scorched termites. With the exception of one individual of *M. acuminata* reared from Monterey cypress, all the American species of *Melanophila* appear to be confined to food-plants of the family Pinaceae. The larval characters indicate that the genus should be divided into two, the larvae of *M. intrusa* and *M. aeneola* having characteristics that distinguish them from the true type of the genus as found in the other species dealt with.

Among the species of which the habitat and host-plants are given is *M. acuminata*, De G., with which *M. longipes*, Say, and *M. atropurpurea*, Say, are apparently identical, which prefers to attack dead or dying trees or those scorched by fire, the hosts being red or Norway pine (*Pinus resinosa*), lodge-pole pine (*P. murrayana*), Monterey cypress (*Cupressus macrocarpa*); while it has also been taken on the bark of yellow pine (*Pinus ponderosa*), Engelmann spruce (*Picea engelmanni*), Sitka spruce (*P. sitchensis*), lowland fir (*Abies grandis*) and giant arborvitae (*Thuja plicata*). *M. consputa*, Lec., has similar habits and attacks Monterey pine (*Pinus radiata*), knobcone (*P. attenuata*) and other pines. *M. gentilis*, Lec., injures sugar pine (*Pinus lambertiana*), rock pine (*Pinus scopulorum*), Jeffrey pine (*P. jeffreyi*) and other pines; it is a particularly dangerous pest, especially to second growth. *M. drummondi*, Kirby, attacks and kills many trees including western larch (*Larix occidentalis*), Sitka spruce (*Picea sitchensis*) (at present very important in the manufacture of aeroplanes), western hemlock (*Tsuga heterophylla*), alpine hemlock (*T. mertensiana*), Douglas spruce (*Pseudotsuga taxifolia*), alpine fir (*Abies lasiocarpa*), white fir (*A. concolor*), lovely fir (*A. amabilis*), noble fir (*A. nobilis*), red fir (*A. magnifica*). *M. fulvoguttata*, Harris, is the most destructive enemy of eastern hemlock and also attacks *Picea* sp., red spruce (*P. rubens*) and common hemlock (*Tsuga canadensis*). *M. californica*, van D., injures digger pine (*P. sabiniana*), Coulter pine (*P. coulteri*) and other pines; it kills many second growth trees and assists bark-beetles to kill others. *M. pini-edulis*, Burke, attacks *Pinus edulis* and assists bark-borers

and bark-beetles to kill the trees. *M. intrusa*, Horn, usually lives in the suppressed limbs of living trees and sometimes attacks saplings. *M. aeneola*, Melsh., infests overtopped branches and trees of scrub pine (*Pinus virginiana*) and other pines.

The only known method of dealing with these beetles in the forests is the burning the infested wood and bark before the adults emerge. Parasites and predators are of considerable assistance in reducing their numbers and as knowledge of these increases and improved methods of forestry are put into practice it is hoped that the depredations of *Melanophila* spp. will be prevented rather than controlled.

Hayes (W. P.). **The Life-cycle of *Lachnosterna lanceolata*, Say.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 1, February 1919, pp. 109–117, 2 figs.

The grubs of *Lachnosterna lanceolata*, Say, during the past few years have caused great destruction every autumn soon after wheat planting in southern Kansas and northern Oklahoma, damaging thousands of acres of young winter wheat. In other parts of Kansas the grubs are abundant on pasture grasses and have also been observed feeding on growing oats. The species is practically confined to the region east of the Rocky Mountains and west of the Mississippi River. The females are wingless and cannot travel far, hence the spread of the species is slow. Two years seems to be the normal length of the life-cycle in Kansas, though in some cases the larval stage is prolonged so that three years is required. The generations overlap, all stages appearing every season. Oviposition begins late in June and extends until August, the eggs being laid singly or in small groups in clumps of soil at a depth of from one to seven inches. These hatch in about 16 days and larvae are present until June of the second year, this stage therefore lasting slightly over 22 months. Pupation occurs in June or July and averages 13 days, the species thus differing from other white grubs that generally pupate in the autumn, having passed through only one winter. A list of food-plants of *L. lanceolata* is given, comprising 27 field species, chiefly native weeds, and 26 plants on which the adults were observed to feed in cages. Wild clover is a favourite food-plant, while lucerne remains almost untouched. In pasture land, ironweed (*Vernonia baldwini*) seems to be preferred, eggs frequently being laid at the base of this plant.

None of the usual parasites of *Lachnosterna* have been noted in Kansas. One adult of *Sarcophaga prohibita*, Ald., was reared from *Lachnosterna* and, while it is the first record of this kind, it is believed to be a true parasite.

Owing to the fact that *L. lanceolata* does not travel far, the injury is cumulative in fields sown with wheat year after year, and increases in severity annually. It follows that one of the best remedial measures is rotation of crops. A rotation of maize, oats and wheat has proved very effective in preventing damage by this species. With a crop of maize or sorghum, the repeated working of the ground destroys large numbers of the grubs. It is found that a change in the system of crops is necessary only once in about five years. The usual methods of turning pigs into infested fields, ploughing immediately after harvest and keeping down weeds both in and around the fields, all assist in the control of these grubs.

Woglum (R. S.). Recent Results in the Fumigation of Citrus Trees with Liquid Hydrocyanic Acid.—*Jl. Econ. Entom., Concord, N.H.,* xii, no. 1, February 1919, pp. 117–123, 2 figs.

Hydrocyanic acid gas has been used for the fumigation of citrus trees in California for more than thirty years and during this time many changes have been made in the apparatus and methods adopted. These are briefly reviewed, and are followed by a discussion of the latest practice, in which liquid hydrocyanic acid is injected by means of a fumigating machine at the edge of the tent as a mist, which on evaporating is left with little initial momentum. Moreover, the gas from liquid hydrocyanic acid is cooled almost to freezing point on formation and consequently is decidedly heavier than the hot, machine- or pot-generated product. As the molecular activity of gases increases proportionately as the temperature, that of the gas from liquid hydrocyanic acid is least when first generated but increases as it attains the temperature of the air, while in pot or machine generated gas the inverse is the case. Thus the initial diffusion is slower in the case of liquid hydrocyanic and is attained throughout the bottom of the tent sooner than at the top.

Hydrocyanic acid gas being lighter than air, it has been natural to suppose that the greatest density, signifying the highest mortality among scale-insects, would be towards the top of the tent, and this has been confirmed in the case of *Dialeurodes citri* (citrus whitefly), *Bruchus* (*Acanthoscelides*) *obtectus* (bean weevil) and *Calandra granaria* (granary weevil). Investigation into the employment of liquid hydrocyanic acid has shown that with this method the scale-mortality was more effective towards the bottom of the tree than towards the top. Tables show the results of this method in the case of *Lepidosaphes beckii* (purple scale) and *Chrysomphalus aurantii* (red scale), both of which bear out the above theory. A dosage schedule for liquid hydrocyanic acid, which will necessitate many changes from the present schedule based on pot generation, is being prepared. Since the infestation of scale-insects on large citrus fruit trees is usually most severe on the lower or more protected part of the tree, the advantage of the liquid hydrocyanic acid fumigation is obvious. Other benefits are the reduction in cost of apparatus, and in the cost of tent repairs, the liquid acid being harmless to cloth. The treatment of small trees can be performed with greater accuracy and certainty of results, greater speed in treatment is possible, and the quantity of hydrocyanic acid required may be slightly less than by the other methods. Improvements are, however, required, in manufacture, so as to furnish a uniformly high grade product; in containers, through the use of material free from chemical action with the gas; and in field application, to guarantee accurate delivery and complete vaporisation of the required charge. Assurance has been given that these faults will be corrected in the immediate future.

Howard (L. O.). *Gracilaria zachrysa*, Meyr.; Corrective Note.—*Jl. Econ. Entom., Concord, N.H.,* xii, no. 1, February 1919, p. 124.

Attention is drawn to the statement made in a recent paper, that *Gracilaria azaleae*, considered identical with *G. zachrysa*, a pest of apple foliage in north-west India, had recently been introduced into

the United States. [See this *Review*, Ser. A, vii, p. 122.] It is now stated that *G. azaleae*, Busck, is not identical with *G. zachrysa*, Meyr., and therefore is not be to feared as an apple pest in the United States.

Back (E. A.) & Duckett (A. B.). **Bean and Pea Weevils.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 983, September 1918, 24 pp., 24 figs. [Received 24th March 1919.]

The species dealt with in this bulletin are:—*Bruchus pisorum*, L. (pea weevil), which in one province of Canada alone has caused damage to the extent of over £200,000 in a single year, *B. obtectus*, Say (bean weevil), *B. chinensis*, L. (cowpea weevil), *B. quadrimaculatus*, F. (four-spotted bean weevil), *B. rufimanus*, Boh. (broad-bean weevil), *B. lentis*, Boh. (lentil weevil) and *Spermophagus pectoralis*, Say (Mexican bean weevil). The usual remedies to prevent loss in storage due to weevils are given, namely, the planting of sound seed, clean culture, immediate harvesting and shelling of the seed, fumigation with carbon bisulphide or carbon tetrachloride, treatment with heat or cold, cold storage, storage with dust or air-slaked lime, and occasional examination of stored seeds to guard against subsequent re-infestation.

Lewis (A. C.) & McLendon (C. A.). **Cotton Variety Tests 1918.**—*Georgia State Bd. Entom., Atlanta*, Bull. 52, January 1919, 38 pp., 1 fig.

This bulletin describes in detail the results of nine tests made with varieties of cotton exhibiting earliness, and therefore adaptation to escape attacks of the cotton boll-weevil [*Anthonomus grandis*], and resistance to wilt disease and anthracnose.

Dash (J. S.). **Quelques Conseils aux Producteurs de Cannes de la Guadeloupe.** [Recommendations to Growers of Sugar-cane in Guadeloupe.]—*Sta. Agron. Guadeloupe, Pointe-à-Pitre, Antilles Françaises*, Bull. no. 1, 1919, 30 pp., 7 figs. [Received 24th March 1919.]

Diatraea saccharalis (moth borer) is considered the worst insect pest of sugar-cane in Guadeloupe (French Antilles), and is found wherever sugar-cane is grown. Other sugar-cane pests of the region are a species of *Lachnosterna*, and the weevils, *Diaprepes abbreviatus* and *D. famelicus*. The usual methods of control are recommended [see this *Review*, Ser. A, iv, p. 256 and v, pp. 365, 410].

Mercet (R. G.). **Parasites of *Porthetria dispar* (Gipsy Moth) in Spain.**—*Revista de Montes, Madrid*, xlii, no. 1004, 1918, pp. 775–781, 2 figs. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 12, December 1918, pp. 1508–1509.)

The caterpillars of *Porthetria dispar* (gipsy moth) are spreading alarmingly in Spain, especially in the neighbourhood of Madrid, where they are very injurious to oaks. There are, however, a number of

Chalcid parasites of the eggs in Spain, which are described. These include *Anastatus bifasciatus*, *Schedius kuwanae*, *Atoposomoidea ogimae*, and a new species of *Tyndarichus*.

FONTANEL (P.). **La Guerre aux Coquerelles.** [Cockroach Extermination.]—*Nat. Canad.*, *Quebec*, xlv, nos. 6, 7, 8; December 1918, January-February 1919; pp. 86-93, 104-110, 117-126.

The gases used for the destruction of cockroaches (*Blatta germanica*) include chlorine and hydrocyanic acid. The former, being readily soluble in water, must be kept away from food and from metallic kitchen utensils. Hydrocyanic acid gas may be generated by using potassium cyanide 1 oz., sulphuric acid 2 oz., and water 4 oz., these quantities being sufficient for the fumigation of 100 cubic ft. It should be used only when fumigating a completely infested house, and as the eggs are not destroyed by it, the treatment should be repeated a month later.

Of other remedies, pyrethrum powder is recommended, if it can be obtained freshly prepared and pure; but the most efficient mixture consists of wheaten flour 5 oz. and potassium cyanide 1 oz., intimately mixed in a mortar. This usually kills in less than 5 minutes and often in less than 1 minute, while even the odour has been known to kill in less than 15 seconds cockroaches passing over it. The efficacy of powdered poisons lies in their being brought into contact with the insect which swallows them in cleaning its limbs and antennae, as is its invariable habit. Another recommended formula that can be used in cases where the presence of a powerful poison is inadvisable, consists of chocolate 1 oz. and borax 1 oz., or cocoa ½ oz., sugar ½ oz., and borax 1 oz.

Finally, after having killed the adults, it is necessary to destroy the bodies, since the eggs being laid in cases, they may be mature and almost ready for extrusion at the time of the death of the adult, in which case they may hatch out as though the insect were viviparous.

De Koolvlieg (*Chortophila brassicae*, **Bch.**). [The Cabbage Root Maggot.]—*Meded. Phytopathologischen Dienst, Wageningen*, no. 8, 1919, 18 pp., 13 figs.

The life-history of *Phorbia* (*Chortophila*) *brassicae*, Bch., in Holland is described, and tarred paper collars are suggested as the best means of protecting the plants [see this *Review*, Ser. A, v, p. 171]. Some of the figures illustrate a punch used for cutting the collars from a roll of tarred paper, a collar ready for application, and cabbages equipped with this protection.

SCHOEVERS (T. A. C.) **Wat nu in den Boomgaard gedaan kan worden ter Bestrijding van Ziekten en Plagen.** [Measures that may be taken in the Orchard at this Period of the Year against Diseases and Pests.]—*Tijdschr. Plantenziekten, Wageningen*, xxv, no. 1, January 1919; Bijblad pp. 1-4.

The title of this popular article intended for owners of orchards indicates its scope.

VAYSSIÈRE (P.). **Sur les Principaux Moyens de Destruction de la Mouche de l'Olive.** [On the Principal Ways of destroying the Olive Fly.]—*Bull. Soc. Nat. Acclimat. France, Paris,* lxvi, no. 3, March 1919, pp. 78–81.

In France, where *Dacus oleae* causes an annual loss of two-thirds of the olive crop, the fly has 2 or 3 generations in the year, according to the temperature. The adults are on the wing in mid-July and again in mid-August, and, if there is a third generation, towards the end of September. Hibernation may take place either in the pupal stage in the soil or in the olive sheds, or in the winged stage under the old bark. Methods of artificial control have already been noticed [see this *Review*, Ser. A, ii, pp. 289, 452 and 479], but as they do not give permanently satisfactory results, more reliance is beginning to be placed on control by natural enemies by the introduction of parasites [see this *Review*, Ser. A, vi, p. 256]. In the opinion of the author, both methods should be employed simultaneously until such natural enemies are firmly established.

KRYGER (J. P.). **The European Trichogramminae.**—*Entomologiske Meddelelser, Copenhagen,* xii, no. 2, 1918, pp. 257–354.

This paper emphasises the scantiness of the present knowledge of the TRICHOGRAMMINAE. The known European representatives of the sub-family comprise 11 genera and 30 species, of which 8 genera and 19 species occur in Denmark. As regards the parasitic habits of these Chalcids, some of which are of considerable economic importance, it is probable that some species are confined to one particular host, while others attack various hosts, *e.g.*, *Trichogramma evanescens* infests the eggs of *Sialis*, Stratiomyids, *Aterix*, *Chrysops*, *Tabanus* and perhaps *Nonagria*. Very little is known either on this point or as to the number of parasites that may be found in a single host. The author is of opinion that only one individual of *Trichogramma* is bred from an egg of *Sialis* and that this is also the case with *Ophioneurus signatus* in the eggs of *Rhynchites betulae*; on the other hand he has bred as many as 13 individuals from a single Lepidopterous egg. It is believed that hibernation is passed in the egg of the host.

Whilst it is considered that there is only a single European species of the genus *Trichogramma*, viz.: *T. evanescens*, Westw., it is admitted that ultimately two others, *T. semblidis*, Auriv., and *T. piniperda*, Wolff, may be recognised. Keys are given to the genera and species of this subfamily, and 12 new species, all from Denmark, are described.

ROEPKE (W.). ***Thamnurgides myristicae*, eine neue javanische Ipide (Col.; Scolytoidea) aus Muskat-Nüssen.** [*Thamnurgides myristicae*, a new Javanese Scolytid infesting Nutmegs.]—*Treubia, Batavia,* i, no. 1, January 1919, pp. 23–29, 7 figs.

In newly gathered nutmegs a small Scolytid beetle, new to science, has been occasionally found in great abundance in Java, and it has also been reported as infesting the nearly mature nutmegs before picking, though the author is unable to confirm this last point. It is here described under the name of *Thamnurgides myristicae*. The development of this pest takes place in the nutmegs lying on the ground,

a large number falling prematurely throughout the Malay Archipelago owing to a fungus disease. Such nutmegs are immature and soft ; the dampness of the ground causes the pericarp to ferment and rot, and numerous insects are attracted to it, including many Nitidulid beetles. The interior becomes watery and is then very susceptible to infestation by *T. myristicae*. Apparently one or more females pierce the shell and prepare a brood-chamber within. Some time afterwards the interior of the nutmeg contains a large hollow of indefinite shape and full of numerous individuals of this beetle in all stages of development. It would therefore appear that several generations occur in the one chamber. Some of the adults leave the nutmeg by the flight-holes. The large brood-chambers are also filled with quantities of brown-black excreta and frass. A mite is also present in them in large numbers and is apparently a parasite, since colonies of *T. myristicae* that were heavily infested with it were found to perish, the freshly-emerged beetles being especially susceptible. It is uncertain whether *T. myristicae* is able to infest perfectly sound and normally ripened nuts, but in the laboratory the beetles seemed unable to bore through the hard shell. Nutmegs that have been smoked and dried were also immune. This pest therefore is of importance only as regards the fallen nuts, which are utilised in Europe in the manufacture of soap and perfumery. Speedy collection and preparation of fallen nuts is the measure advised, while all useless nuts should be burnt or buried.

Roepke (W.). **Een Termitophile Trocholdeine van Java : *Trochoideus termitophilus* n. sp. ? (Coleopt. : Endomychidae).** [A termitophilous Endomychid, *Trochoideus termitophilus*, sp. n. ?]—*Treubia, Batavia*, i, no. 1, January 1919, pp. 34–45, 12 figs.

Trochoideus termitophilus, described in this paper, is associated with *Termes gilvus*, Haged., a common termite in Java, though nothing definite is known as to its relations with it.

Schmitz (H.). **Drei neue Termiten vom belgischen Kongo.** [Three new Termites from the Belgian Congo.]—*Tijdschr. Entomologie, The Hague*, lx, no. 1-2, 15th July 1917, pp. 225–231, 3 figs. [Received 18th March 1919.]

The new termites here described are *Microcerotermes secernens, Promirotermes gracilipes* and *Procubitermes undulans*.

LEGISLATION.

Quarantine Order No. 31 (with Regulations). Alfalfa Weevil.—*Mthly. Bull. California State Commiss. Hortic., Sacramento*, viii, no. 1, January 1919, pp. 34-35.

This Order decrees, as a prevention against the introduction of the alfalfa weevil [*Hypera variabilis*] into the State of California, that a horticultural quarantine be established at the boundaries of the State, against all lucerne hay and other hay and cereal straw, salt grass packing, agricultural emigrant movables, live stock, potatoes and nursery stock, except as provided by certain affixed regulations.

DE MEIJERE (J. C. H.). **Studien über südostasiatische Dipteren xiii. Ueber einige merkwürdigen javanischen Dipteren.** [Studies on south-east Asiatic Diptera xiii. Some remarkable Javanese Diptera.]—*Tijdschr. Entomologie, The Hague,* lx, no. 1–2, 15th July 1917, pp. 238–251, 5 figs. [Received 18th March 1919.]

A new Cecidomyid, *Coccodiplosis pseudococci*, gen. et sp. n., is here described from Java. The larvae feed upon scale-insects, including various species of *Pseudococcus*, such as *P. adonidum*, *P. citri*, *P. crotonis*, etc. Other new Diptera from Java include a Muscid, *Pentatomophaga bicincta*, gen. et sp. n., bred from the coffee bug, *Pentatoma plebeia*, Voll., and an Agromyzid, *Agromyza tephrosiae*, the larvae of which mine in the leaves of *Tephrosia*.

ROEPKE (W.). **Eenige Opmerkingen over twee Javaansche Canthariden: *Mylabris pustulata*, Thunb., en *Epicauta ruficeps*, Ill.** [Some Observations on two Javanese Cantharids, *M. pustulata*, Thunb., and *E. ruficeps*, Ill.]—*Tijdschr. Entomologie, The Hague,* lx, no. 1–2, 15th July 1917, pp. 252–267, 4 figs., 2 plates. [Received 18th March 1919.]

The Meloid beetles, *Mylabris pustulata*, Thunb., and *Epicauta ruficeps*, Ill., are natural enemies of the locust, *Cyrtacanthacris nigricornis*, Burm., in Java, the larvae of both species feeding on the eggs.

ROEPKE (W.). **Zur Myrmekophilie von *Gerydus boisduvali*, Moore (Lep. Rhop. Lycaenid).** [The Myrmecophilous Lycaenid, *G. boisduvali*, Moore.]—*Tijdschr. Entomologie, The Hague,* lxi, no. 1–2, 15th July 1918, pp. 1–16, 2 figs. [Received 18th March 1919.]

The Lycaenid, *Gerydus boisduvali*, Moore, has been observed in Central Java attending colonies of the scale, *Pseudococcus crotonis*, on cacao plants infested with the black cacao ant, *Dolichoderus bituberculatus*. The butterfly strokes the scales with its proboscis and drinks their secretions. The swarms of black ants in no way interfere with its activities and they, in turn, are not disturbed by it. A number of the Lycaenid pupae were found in an old nest of *D. bituberculatus* used in cacao plantations to encourage this ant.

VAN DER GOOT (P.). **Notes on Oriental Aphididae.**—*Tijdschr. Entomologie, The Hague,* lxi, no. 1–2, 15th July 1918, pp. 112–127, 5 figs. [Received 18th March 1919.]

The Aphids from Singapore here recorded include *Macrosiphoniella citricola*, v. d. G., on *Cinnamomum*; *Micromyzus varicolor*, v. d. G., on a small epiphytic fern (*Cyclophora* sp. ?); *Melanaphis bambusae*, Fullaway, on *Bambusa nana*; *Aphis malvoïdes*, v. d. G., on an unknown shrub; *Trichosiphum roepkei*, sp. n., on an unknown tree (*Eurya* sp. ?); *Glyphinaphis bambusae*, v. d. G., on bamboo; *Oregma muiri*, sp. n., on an unknown plant (*Amomum* sp. ?); *O. rhapidis*, v. d. G., on coconut and other palms, where this species was always visited by the ants, *Oecophylla smaragdina* and *Camponotus* sp.; *O. singaporensis*, sp. n., on bamboo; and *O. sundanica*, v. d. G., on an unknown plant (*Amomum* sp. ?).

During a two hour's stay at Hongkong the following species were found: *Melanaphis bambusae*, Fullaway, on bamboo; *Lachnus agilis*,

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Kalt., and *L. tomentosus*, de G., on *Pinus* sp.; *Greenidea artocarpi*, Westw., on *Ficus* sp.; *Oregma minuta*, v. d. G., on bamboo; *Thoracaphis fici*, v. d. G., on *Ficus benjamina*; *T. hongkongensis*, sp. n., on an unknown tree; and *Pineus pini*, Börner, on *Pinus* sp. The new species are described and figured.

SMITS VAN BURGST (C. A. L.). **Sluipwespen, gekweekt uit de Dennenlotrups (*Evetria buoliana*, Schiff.); *Perilampus batavus* n. sp.** [Parasitic Hymenoptera bred from *Rhyacionia* (*Evetria*) *buoliana*; *Perilampus batavus*, sp. n.]—*Tijdschr. Entomologie, The Hague*, lxi, no. 3–4, 15th February 1919, pp. 143–146.

The parasitic Hymenoptera bred from *Rhyacionia* (*Evetria*) *buoliana*, Schiff. (pine-shoot moth) include *Pimpla buolianae*, Htg., *P. ruficollis*, Grv., *P. examinator*, F., *P. alternans*, F., *P. turionellae*, L., *P. brevicornis*, Grv., *P. inquisitor*, Sc., and *P. sagax*, Htg.; *Glypta resinana*, Htg.; *Lissonota folii*, Ths., *L. buolianae*, Htg., *L. humerella*, Ths. (it is considered that the two first-named species of *Lissonota*, and *L. transversa*, Bridgm., are one species, for which the name *L. buolianae* should have priority); *Eulimneria crassifemur*, Ths. (probably identical with *Campoplex lineolatus*, Bch.); *Omorgus ramidulus*, Brischke; *Cremastus confluens*, Grv. (*C. interruptor*, Grv., recorded by Ratzeburg as a parasite of *R. buoliana* in Germany, is probably the same species); *Pristomerus vulnerator*, Panz., and the Braconid, *Orgilus obscurator*, Nees. A new Chalcid, *Perilampus batavus*, parasitic on this moth, is also recorded, but not described.

SCHNEIDER-ORELLI (O.). **Ueber einige in der Schweiz noch wenig beachtete Insekten an Kulturpflanzen.** [Some unusual Insects on cultivated Plants in Switzerland.]—*Verh. Schw. Naturf. Ges., Aarau*, Year 1917, no. 2, 1918, pp. 273–274.

In the summer of 1916 and 1917 large numbers of *Stephanitis pyrioides*, Scott, appeared on azaleas in the neighbourhood of Zurich. The larva and imago attack the underside of the leaves, causing rusty spots and in severe cases the fall of the foliage. An allied Tingid, *S. pyri*, L., sucks the leaves of apple and pear trees. It is found in the canton of Tessin, but not as yet in Northern Switzerland. In the case of both species, the winter is passed in the egg-stage. A new Cecidomyid, a species of *Dasyneura*, is reported as causing malformation of the ends of the shoots of *Arabis albida* in Zurich, and *Monarthropalpus buxi*, Lab., mines in the young leaves of *Buxus sempervirens*, sometimes appearing in great numbers in North-East Switzerland.

FERRIÈRE (C.). ***Tetrastichus asparagi*, Crawf., Parasite du Criocère de l'Asperge.** [*T. asparagi*, Crawf., Parasite of *Crioceris asparagi*.]—*Verh. Schw. Naturf. Ges., Aarau*, Year 1917, no. 2, 1918, pp. 276–277.

This Chalcid parasite was discovered at Tillenay (Côte d'Or) in June 1914 in asparagus fields infested with *Crioceris asparagi*, and this appears to be the first record of its occurrence in Europe, it having been originally described from the United States [see this *Review*, Ser. A, i, p. 15].

The infested larvae of *C. asparagi* develop normally until they are ready to pupate in the ground, the parasite pupating in the nymphal chamber prepared by the beetle in the earth near asparagus roots. During the winter the parasite may be transported in this stage from one district to another. This Chalcid is a very important enemy of *C. asparagi*, and everywhere that it has been observed it has exerted a marked degree of control on this asparagus pest.

PICTET (A.). **Les Migrations de *Pieris brassicae* en Suisse, en 1917.**—*Verh. Schw. Naturf. Ges., Aarau*, Year 1917, no. 2, 1918, pp. 277–278.

There were four occasions during 1917 when the butterflies of *P. brassicae* occurred in large numbers. Their first appearance was during the first fortnight in July, and these were local individuals, the caterpillars derived from which were full-grown in the first half of August and completely ruined the cabbage crop. The second and third outbreaks were due to two tremendous swarms that crossed the whole of Switzerland from North to South, the first from 19th–22nd July and the second from 27th–29th of the same month. Probably owing to the fact that the caterpillars of the first outbreak had practically destroyed the cabbage crops, these swarms passed straight on over the Jura mountains and the Alps to the south, and the eggs deposited by them on their passage over Switzerland were only about 10 per cent. of those laid by the first and last swarms. The latter was composed of local individuals that were descendants of the first outbreak. The caterpillars derived from these appeared in immense numbers on what remained of the cabbages towards the end of August. The scarcity of Braconid parasites of the genus *Microgaster* in 1916 explains in part the tremendous number of *P. brassicae* in 1917.

LEFROY (H. M.) & ANSORGE (E. C.). **Report on an Inquiry into the Silk Industry in India. Vol. i, The Silk Industry. Vol. ii, Present Condition of the Silk Trade of India. Vol. iii, Appendices to Vol. i.** —*Calcutta*, 1917, pp. 1–211, 1–115 & 1–227. Published 27th March 1919.

In consequence of the steady decline of the silk industry for a number of years, the Government of India proposed an enquiry into the question, and this was begun on 1st December 1915. The results are contained in these comprehensive reports. The diminution in silk production, which is most marked in Bengal, was found to be due to the increased production of silk in Japan, to diseases among the silkworms, of which the most serious are pebrine (*Nosema apicis*), flacherie, grasserie, muscardine (*Botrytis bassiana*), the presence of a parasite, the increased value of other crops and the inferiority of the Bengal variety of silkworm. With a better race (which is now available) and with the existing resources in nurseries, the industry can be largely revived if the new hybrid races are introduced and if a competent European officer is appointed to organise the introduction. The problem varies greatly with different regions, but the essential improvements throughout are expert organisation and the supply of good strains of silkworms.

CAILLOL (H.). **Description d'un *Acanthoscelides* nouveau, de Timbouctou (Col., Bruchidae).**—*Bull. Soc. Entom. France, Paris*, 1919, no. 2, 22nd January 1919, pp. 53–54.

A Bruchid, *Bruchus* (*Acanthoscelides*) *trabuti*, sp. n., is described occurring in the seeds of *Vigna sinensis* (cowpea), from Timbuctoo.

LICHTENSTEIN (J. L.) & PICARD (F.). **Notes biologiques sur les Braconides (Hym.). 2e note.**—*Bull. Soc. Entom. France, Paris*, 1919, no. 2, 22nd January 1919, pp. 62–64.

Since the publication of a previous note [see this *Review*, Ser. A, vi, p. 476], *Spathius pedestris*, Wesm., has been obtained from fig-trees containing only *Anobium striatum*, Oliv., and *Gastrallus laevigatus*, Oliv.; the parasitism of this species on Anobiids is therefore confirmed. *S. curvicaudis*, Ratz., is recorded for the first time in France, two individuals having been taken in flight. *Dendrosoter protuberans*, Nees, was obtained from pines attacked by *Pityogenes quadridens*, Hart., and also from *Scolytus multistriatus*, Marsh., in branches of *Rhamnus alaternus*, L. *D. ferrugineus*, Marsh., which has previously been recorded as parasitic upon *Sinoxylon sexdentatum* [*loc. cit.*], has also been taken in numbers parasitising *Scobicia chevrieri*, Villa, on fig. It is an external parasite, the larva devouring the body of its host and then pupating in the gallery constructed by it. *Doryctes leucogaster*, Nees, which had been reared from fig branches, was previously thought to be a parasite of *Hesperophanes griseus*, F., but is now found to attack *Clytus pilosus*, Forst. (*glabromaculatus*, Goeze). *D. pomarius*, Reinh., a parasite of Scolytids, has been found to attack *Ips laricis*; this species had not previously been recorded in France. *D. striatellus*, Nees, has been observed, in company with *Dorcatoma dresdensis*, Hbst., and *D. setosella*, Muls., issuing from a fungus on cherry and plum trees; this species is therefore apparently not parasitic upon Longicorns. *Sigalphus caudatus*, Nees, has already been noted as parasitic upon several insects; to these may be added *Thamnurgus euphorbiae*, Küst., in stems of *Euphorbia characias*. *S. luteipes*, Thoms., destroys *Bruchus affinis*, Frölich, in pods of *Lathyrus silvestris*. *Apanteles sicarius*, Marsh., previously known only in England, where it is parasitic upon larvae of the moth, *Polychrosis* (*Sericoris*) *littoralis*, Westw., was bred at Montpellier in June from larvae of *Hemerophila* (*Simaethis*) *nemorana*, Hb., on fig.

SMITH (H. S.). **Biennial Report of the Insectary Division, State Commission of Horticulture, 1917-18.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 2, February 1919, pp. 44–51, 2 figs.

During the two years under review two expeditions were made to Australia for the purpose of discovering and importing into California natural enemies of *Eutettix tenella* (sugar-beet leaf-hopper); this insect, owing to its connection with the curly-top disease of sugar-beet, has in some seasons caused a loss of over £200,000 to the sugar industry. A number of enemies of leaf-hoppers were imported into California, but owing to the difference in climatic and other environmental conditions, they failed to become established.

The Government of Uruguay has been supplied with a colony of an Agromyzid fly, *Cryptochaetum* (*Lestophonus*), for use against the

cottony cushion scale [*Icerya purchasi*], and a colony of *Novius cardinalis* has been promised as soon as available. Colonies of various beneficial insects, principally *Novius cardinalis*, *Cryptolaemus montrouzieri*, *Cryptochaetum* (*Lestophonus*) *iceryae* and *Paraleptomastix* have been sent to Florida, Louisiana, Texas and Arizona. Colonies of a Coccinellid, *Delphastus*, feeding on Aleurodids have also been sent to Florida where they now occur in tens of thousands in the citrus orchards and are doing a remarkable amount of good. In return for this, colonies of *Laetilia coccidivora*, a moth predaceous on various scale-insects, have been received from Florida. A colony of a species of *Scymnus*, an enemy of mealy-bugs has been received from the Hawaiian Sugar Planters' Station, and a consignment of *Pauridia peregrina*, an internal parasite of the Japanese mealy-bug, *Pseudococcus kraunhiae*, is in course of preparation, an outbreak of this pest having recently occurred in one locality. During the spring of 1918, two colonies, comprising a total of 1,000 individuals of *Calosoma sycophanta*, a Carabid beetle predaceous on tree-infesting caterpillars, were received from Massachusetts. This beetle introduced from France to destroy the gipsy moth [*Porthetria dispar*] has proved so successful, being particularly valuable against tree-infesting caterpillars, that it has been introduced into three districts in California against the forest tent caterpillar [*Malacosoma disstria*], the Californian oak moth [*Phryganidia californica*], and the brown day moth [*Pseudohazis eglanterina*] respectively, though it remains to be seen whether the beetle will thrive on these species.

During the season about 75,000,000 individuals of the Aphid-destroying Coccinellid, *Hippodamia convergens*, were distributed to the farmers and fruit-growers in the State.

Brann (F. R.). **Factors concerning the Drop of Immature Citrus Fruit in Central California.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 2, February 1919, pp. 74–75.

The fall of citrus fruits, which occurs when the fruit is first formed in April, is caused to some extent by insect pests. Of these, *Coccus citricola*, Campb. (grey scale), *Scirtothrips citri*, Moult. (citrus thrips), *Toxoptera aurantiae*, Koch (black citrus aphis), and *Myzus* (*Rhopalosiphum*) *persicae*, Sulzer (green peach aphis), damage a certain proportion of the fruit, and though under normal conditions the effect on the fall is comparatively slight, in cases of severe infestation by *C. citricola*, the weakened fruit is rather seriously attacked by thrips and Aphids. The citrus thrips is checked more by wet winters than by any other factor, and Aphids, enormous numbers of which are produced on cover crops, are best controlled by the Coccinellid, *Hippodamia convergens*, if arsenical sprays are kept off the trees. Katydids are not a serious pest and are held in check by birds and an egg-parasite, *Eupelmus mirabilis*.

Maskew (F.). **Quarantine Division. Report for the Month of December, 1918.** — *Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 2, February 1919, pp. 84–86.

The following insect pests were intercepted during December:—From Australia: Ptinids in seeds of *Ceratonia siliqua*. From Central America: *Pseudococcus* spp. and *Aspidiotus cyanophylli* on bananas.

From China: Lepidopterous larvae in seed pods, herbs and beans, and *Cylas formicarius* in sweet potatoes. From Florida: *Chrysomphalus aonidum* on citrus fruit; *Lepidosaphes beckii* on citrus fruit and *Hibiscus*; *Aspidiotus* spp. on vanilla plants; *Howardia biclavis* on *Hamelia*; *Parlatoria* spp. on *Alpinia*; *Ischnaspis longirostris* on cholcos. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapples; *Coccus longulus* on betel leaves. From Japan: Larvae of an undetermined weevil in chestnuts and undetermined Coccids on tangerines. From Mexico: larvae of *Diatraea saccharalis* in sugar-cane; an undetermined Coccid on *Croton*; *Pseudococcus* spp. on herbs; *Schizotetranychus* (*Tetranychus*) *mytilaspidis* on lemons; *Chrysomphalus aurantii* on oranges. From Nicaragua: *Calandra oryzae* in maize. From South Africa: *C. oryzae* in maize and sunflower seed. From Missouri: *Aegeria* (*Sanninoidea*) *exitiosa* in peach trees. From Oregon: *Aspidiotus perniciosus*, *Lepidosaphes ulmi* and *Cydia pomonella* on apples; *Eriosoma lanigerum* on fruit trees; *Hartigia cressoni* in raspberry cuttings. From Texas: *Lepidosaphes beckii* and *Parlatoria* spp. on oranges. From Washington: *Lepidosaphes ulmi*, *Aspidiotus perniciosus* and *Cydia pomonella* on apples.

COLLINGE (W. E.). **Some further Investigations on the Food of Wild Birds.**—*Jl. Bd. Agric., London*, xxv, no. 12, March 1919, pp. 1444–1462, 2 figs.

The examination of the stomach contents of a further series of 8 species of wild birds, and the estimation of the food contents by the volumetric method has now been completed [see this *Review*, Ser. A, vi, p. 478.]

The stomach contents of 798 adults and 166 nestlings belonging to these species have been examined and diagrams are given showing the proportion of injurious insects destroyed in each case. The conclusions have been reached that (1) the jackdaw, yellow bunting, great tit, blue tit, song thrush and fieldfare are distinctly beneficial; (2) the great tit, blue tit and fieldfare are beneficial to such an extent that their protection is advisable; (3) in spite of the damage it does, it would be unwise to recommend any repressive measures for the chaffinch; (4) the starling has been allowed unduly to increase till at the present time it is far too numerous and the damage it does is far greater than the benefits it confers. Temporary repressive measures would, no doubt, help to restore a more normal population of this bird, with considerable benefit to both the farmer and the fruit-grower.

Consideration of the food percentages of these and of the species previously examined shows that birds as a class are beneficial and that the benefits they confer are more than twice as great as the injuries they inflict.

MIYAKE (T.). **Studies on the Fruit-flies of Japan. Contribution I. Japanese Orange-fly.**—*Bull. Imp. Central Agric. Expt. Sta. Japan, Nishigahara, Tokyo*, ii, no. 2, February 1919, pp. 85–165, 9 plates, 5 figs.

Dacus tsuneonis, a new fruit-fly infesting orange orchards in the Island of Kiushiu, is described. Its distribution is apparently strictly

limited to the Island, where its destructiveness varies from 10 per cent. to 50 per cent. of the crop. The flies begin to appear at the end of June, reach their maximum emergence during July, and diminish towards the end of August, being occasionally found as late as October. The duration of adult life is about one month; the flies are usually found in shady, thickly wooded places, so that orchards of young trees or those exposed to strong wind are generally free from attack, and they do not travel far from their place of emergence. Oviposition occurs in August, eggs being laid under the rind. Thick-skinned oranges are seldom attacked, as the ovipositor is not long enough to reach the pulp. A single puncture is usually made in each fruit, and though there are frequently from 2 to 6 eggs in each puncture, only one larva emerges from each. The period of incubation was not determined, but in one case observed hatching did not occur until the 8th day after oviposition. Larvae appear about the beginning of October and devour the contents of one carpel after another, from 2 to 10 carpels being infested by a single maggot. By the beginning of November the larvae are mature and about this time the infested fruit falls. Within a few hours the larva issues from the orange and enters the ground for pupation. Occasionally the larva leaves the orange while it is still on the tree. The resistance of the larvae to both sea and fresh water is very marked; five days' submergence in water prevents the pupation and emergence of adults to a certain extent; after 10 days submergence in sea-water or over 24 days in well-water the maggots apparently do not survive. Pupation occurs at a depth of 1 to 2 inches in the soil and lasts from the end of November to the end of December or January. Burying the pupae to a depth of 1½ ft. in the soil did not kill them.

No definite parasites of *D. tsuneonis* have yet been found; dragonflies and Asilids are probably predaceous on it. Preventive measures in infested localities include capturing the adult flies, collecting and treating infested fruit to kill the larvae, and gathering the pupae. It is recommended that adults should be captured and infested fruit picked up as quickly as possible. Infested oranges should be used as raw material for the preparation of citric acid and the construction of storehouses for oranges should be improved.

Descriptions are also given of the following new fruit-flies from various localities in Japan:—*Dacus (Chaetodacus) bezzii*, abundant in orange-orchards from July to September but not yet found to do any injury to the fruit, *Hypenidium polyfasciatum*, *Acidia kagoshimensis*, *A. marumoi* taken at an elevation of 5,000 ft., and *Gastrozona japonica*.

NISHIKAWA (I.). **Kasan no Gaichu ni Kuwansuru Kenkyu-tsuzuki.** (Studies on Insect Enemies of the Silkworm, continued.)—*Sangyo Shimpo (Journal of the Silk Industry), Tokyo,* xxvii, no. 312, 1st March 1919, pp. 244–251.

The additional insect enemies of silkworms here recorded [see this *Review*, Ser. A, vii, p. 99] are:—The Carabid beetle, *Chlaenius pictus*, Chaud., the larva of which occurs in July and August on mulberry foliage infested with the caterpillars of *Glyphodes pyloalis*, Wlk., on which they feed. When mature, they pupate in the soil at a depth of 1–2 inches in the latter part of August. The adults appear at the

beginning of September, and when introduced among the mulberry leaves, attack the silkworms. Other silkworm enemies are *Dermestes coarctatus*, Har., the larva of which has once been recorded as feeding on the eggs; a Pentatomid bug, *Halyomorpha? picus*, F., appearing in May and June; ants, which are occasional enemies; a wasp, *Polistes hebraeus*, F.; an undetermined Ixodid tick; and a Nematode.

KUWANA (I.). **San-Hose-Kaigaramushi no Henshu to Kiseishokubutsu ni tsuite.** (On the Varieties of the San José Scale and their Food-Plants.)—*Byochugai Zasshi (Journal of Plant Protection), Tokyo*, vi, no. 2, 5th February 1919, pp. 1-5.

In a previous paper (Special Report of the Imperial Agricultural Experiment Station, No. 19.) the author has disputed the existence of the varieties of *Aspidiotus perniciosus*, Comst., established by Cockerell, viz. var. *andromelas*, Ckll., and *albopunctatus*, Ckll. In this article he makes further additions to the food-plants of this scale and confirms the fact that the original San José scale infesting apple may migrate to *Citrus (Poncirus) trifoliata*, while the var. *albopunctatus*, which was said to infest only *Citrus*, migrates to the pear.

CORY (E. N.). **Report of the State Entomologist.**—*Rept. Maryland Agric. Soc., College Park, Md.*, ii, for Year 1917, 1st March 1918, pp. 74-84. [Received 5th April 1919.]

The chief insect pests of Maryland in 1917, of which a brief account is given with notes on their control, included:—*Cydia (Laspeyresia) molesta*, Busck (oriental peach moth), *Eulecanium (Lecanium) nigrofasciatum*, Perg. (terrapin scale), *Aegeria (Sanninoidea) exitiosa*, Say (peach tree borer), *Thyridopteryx ephemeraeformis*, Steph. (evergreen bagworm), *Eriosoma lanigerum*, Hausm. (woolly aphis), *Macrosiphum solanifolii*, Ashm. (potato or tomato aphis), *Diabrotica vittata*, F., and *D. duodecimpunctata*, Oliv. (cucumber beetles), *Epilachna borealis*, F. (squash ladybird), *Aphis rumicis*, L. (bean aphis), *A. gossypii*, Glov. (melon aphis), *Papaipema nebris*, Guen. (*nitela*) (stalk borer), *Lema trilineata*, Oliv. (three-lined potato beetle), *Aphis maidiradicis*, Forbes (corn root aphis), *Crambus caliginosellus*, Clem. (corn webworm), *Termes flavipes*, Kohl., on geraniums, a bug, *Entylia sinuata*, F., on dahlias, *Pseudococcus citri*, Risso, on *Catalpa*, and *Hylotrupes ligneus*, F., in the beams of a factory.

BUSCK (A.). **Two Microlepidoptera injurious to Strawberry.**—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 3, March 1919, pp. 52-53.

Tortricodes fragariana, sp. n., is described from Victoria, British Columbia, breeding commonly in the buds at the head of the crowns of strawberries; and *Aristotelia fragariae*, sp. n., the so-called "strawberry crown borer" from the same habitat, a species on which there is much economic literature, but which has never received a specific name.

BARBER (H. S.). **Avocado Seed Weevils.**—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 3, March 1919, pp. 53-60, 1 plate.

In 1918, avocado growers in Florida were warned against the possibility of the introduction of *Heilipus lauri*, Boh. (avocado weevil), against which quarantine regulations had been issued [see this *Review*,

Ser. A, vii, p. 21]. There are two forms of *Heilipus*, so distinct that it seems best to use distinctive names for them, though it is probable that intermediate forms will be discovered in avocado seed from other tropical American localities that will reduce the new form to the rank of a subspecies. In the meantime they are differentiated under the names, *H. lauri*, Boh., and *H. pittieri*, sp. n., the characteristics of each being described; the former occurs in avocado seed from Mexico and the latter in seeds of *Persea pittieri* from Costa Rica.

A species of *Conotrachelus* that has been commonly found in imported avocado seed remained unidentified until after its close relationship with Florida specimens of *C. serpentinus*, Boh., was noticed. Although the females of the two species are frequently indistinguishable, the characters of the males are so different that the second is described as *C. perseae*, sp. n. The larval galleries of this species are about 4 mm. in diameter in the seed and are packed with frass. When the larvae are numerous the seed may be badly riddled, but the germ often remains uninjured. Occasionally the larvae pupate in rotten seeds, but generally leave the seed and transform in the ground. The pupal period lasts about two weeks. It is supposed that eggs are laid in the young fruit. The author considers that *C. ventralis*, Lec., must be treated as a synonym of *C. serpentinus*.

Another weevil, *Rhyncolus lauri*, Gyll., was described about eighty years ago from seeds of avocado from Mexico, and since that time no one seems to have been able to identify this species. It appears to be closely allied to *Caulophilus latinasus*, Say, which was described about the same time. A small Scolytid from avocado seed from Panama has not yet been described, but it is believed to represent a new genus related to *Spermatoplex*. Another Scolytid that occurs from Chili to Mexico, in Cuba, and has been recorded from Florida boring in seeds of *Persea borbonia*, *Anona glabra* and *A. cherimolia*, and in maize, is probably *Pagiocerus rimosus*, Eich.

Trioza magnoliae, Ashm., has been recorded as living upon *Magnolia, glauca*, but it is thought that this was an error and that the true food-plant is *Persea borbonia*. *T. magnoliae* is very similar to *T. koebelei*, Kirk., which has been described as very destructive in Mexico in galls on *Persea gratissima*. Whether or no these two prove to be synonymous, it is evident that the Florida Psyllid may adapt itself to and become destructive to cultivated avocado.

Other insects that have been recorded as avocado pests include *Cryptorrhynchus ferratus*, infesting branches of *Persea carolinensis* in Florida, and the Scolytids, *Xyleborus immaturus*, *Hypothenemus eruditus* (?) and *Crossotarsus externedentatus*, the last two boring into large avocado trunks in Hawaii. Many Coccids, an undetermined species of the Lepidopterous genus *Stenoma*, and a few miscellaneous insects have also been reported as injurious to this plant.

BEZZI (M.). **New Ethiopian Fruit-flies of the Genera *Tridacus* and *Dacus* (Dipt.).**—*Bull. Entom. Research, London*, ix, no. 3, March 1919, pp. 177-182, 3 figs.

This paper deals with further new African fruit-flies [see this *Review*, Ser. A, v, p. 502]. The new species described are: *Tridacus stylifer* from British East Africa, *Dacus trigonus*, from S. Nigeria and *Dacus macer* from Uganda.

TOTHILL (J. D.). **Some Notes on the Natural Control of the Oyster-shell Scale** (*Lepidosaphes ulmi*, L.). — *Bull. Entom. Research, London*, ix, no. 3, March 1919, pp. 183–196, 7 figs.

The eggs of this scale are free from parasites; birds devour them, but not in sufficient numbers to be of any use as a factor in control. By far the most important factor is a mite, *Hemisarcoptes malus*, Shimer, which in Canada, as in Iowa and in France, is able to hibernate in all stages. In some districts the scale has been practically exterminated owing to the action of this mite.

In the postembryonic stage of *L. ulmi* a great many of the insects are washed off by the rain and perish on the ground. Overcrowding has also been known to be the cause of the death of nearly all the females before oviposition.

The Hymenopterous parasites of this scale in North America are: *Chalcis* (*Aphelinus*) *mytilaspidis*, Le B., *Aspidiotiphagus citrinus*, Craw, *Aphelinus fuscipennis*, How., *A. abnormis*, How., *Anaphes gracilis*, How., and *Chiloneurus diaspidinarum*, How., the first of these being the most important.

In addition to *H. malus* another mite, *Monieziella augusta*, Banks, is a scavenger on the bodies of the females and the eggs already partly eaten by *H. malus*. Mites associated with this scale, but not known to feed upon it, are, *Tydeus gloveri*, Ashm. (which is probably the species identified by Ewing and Webster as *T. coccophagus*), *Gamasus* sp., *Bdella brevitarsis*, Banks, and *Galumna* sp.

BRAIN (C. K.). **The Coccidae of South Africa—iii.**—*Bull. Entom. Research, London*, ix, no. 3, March 1919, pp. 197–239.

This further instalment [see this *Review*, Ser. A, iv, p. 134, vii, p. 138], deals with the genera *Cryptaspidiotus*, *Chrysomphalus*, *Pseudaonidia*, *Parlatoria*, *Aonidia*, *Gymnaspis*, *Howardia*, *Fiorinia*, *Diaspis* (with its sub-genera, *Aulacaspis* and *Epidiaspis*) and *Chionaspis*. It also includes a key to the South African species of *Chrysomphalus* and *Pseudaonidia* and to the subgenera of *Chionaspis*, viz. :—*Chionaspis* s. str., *Pinnaspis*, *Phenacaspis*, *Poliaspis* and *Dinaspis*.

The new species described are :—*Chrysomphalus* (*Pseudischnaspis*) *corticosus* on wild olive, *Virgilia capensis*, *Erythrina caffra*, apple, hawthorn, kei-apple, lilac, *Celastrus* sp., olive, pear, poplar, plane, privet, pepper (*Schinus molle*), *Robinia* sp., rose, peach, plum and walnut; *Pseudaonidia laciniae* on ? *Acacia melanoxylon*; *P. lycii* on *Lycium afrum*; *P. nigra*; *Aonidia chaetachmeae* on *Chaetachme aristata*; *A. rhusae* on *Rhus* sp.; *A. mesembryanthemae* on *Mesembryanthemum edule*; *A. marginalis*, *A. badia*, *Gymnaspis faurei* and *Diaspis rhusae* all on *Rhus* sp.; *Diaspis* (*Epidiaspis*) *conspicua* on privet, acacia, and *Gardenia fortunei*; *Chionaspis margaritae* and *C. humilis* on aloe; *C. capparisi* on *Capparis albitrunca*; *C. euphorbiae* on *Euphorbia*; *C. chaetachmae* on *Chaetachme aristata*; *C.* (*Phenacaspis*) *visci* on mistletoe; *C. globosus* on *Euphorbia*; and *C.* (*Poliaspis*) *kiggelariae* on wild peach (*Kiggelaria africana*) and willow.

BEZZI (M.). **Two new Ethiopian Lonchaeidae with Notes on other Species (Dipt.).**—*Bull. Entom. Research, London*, ix, no. 3, March 1919, pp. 241–254, 4 figs.

Little is known of the African species of this family. A key is given to the known species with descriptions of two new ones: *Lonchaea mochii* from Eritraea and *L. plumosissima* from West Africa bred from vegetable marrow and from fruits of *Sarcocephalus esculentus* infested with a fruit-fly, *Ceratitis cosyra.*

PADDOCK (F. B.). **Studies on the Harlequin Bug.**—*Texas Agric. Expt. Sta., Austin*, Bull. no. 227, April 1918, 65 pp., 5 plates, 4 figs. [Received 10th April 1919.]

Central America is probably the original habitat of *Murgantia histrionica*, although it has a wide distribution, occurring in South America as well as the Eastern United States, and has gradually spread to California. The bulk of the information here given is an amplification of a previous article [see this *Review*, Ser. A, vi, p. 300]. Notes on synonomy and the species allied to this Pentatomid bug, with a detailed description of the life-history, are given. Various observations were made of the duration of the different stages according to climatic conditions, and these are illustrated by a number of tables. Natural enemies that have been recorded are:—The Proctotrupid parasites, *Trissolcus murgantiae*, Ashm., and *T. podisi*, Morg., and the fire ant, *Solenopsis geminata*, F. Poultry are said not to eat this bug in any stage.

PATCH (E. M.). **Eastern Aphids: a few Species of *Prociphilus*.**—*Maine Agric. Expt. Sta., Orono*, Bull. 270, April 1918, 100 pp., 2 figs. [Received 10th April 1919.]

Prociphilus tessellatus and *P. venafuscus* are the only two species of the genus of which the complete American food-cycle has been ascertained in New England; the latter was definitely located from the pupae collected by the author on the roots of balsam fir in October 1915. *P. xylostei* has been recorded in Europe as a root form on conifers and its habits are probably similar in America. The two ash-frequenting species of the Eastern States are *P. fraxinifolii* and *P. approximatus*, the alternate host of which has not yet been found. The autumn migrant of a species found in enormous numbers on mountain ash (*Pyrus* sp.) in 1912 is figured. This is believed to be *P. fitchi*, Bak. & Daw. A species found on the roots of Compositae and believed to be *Trama erigeronensis* is also figured, and if this view is correct, this species should be transferred to the genus *Prociphilus.*

This bulletin also contains a further instalment of the author's food-plant catalogue of the APHIDAE of the World.

LOUNSBURY (C. P.). **Division of Entomology. Annual Report, 1917-1918.**—*Union S. Africa Dept. Agric. Rept., Cape Town*, 1918, pp. 87–107. [Received 10th April 1919.]

Nursery inspection was carried out very thoroughly during the year, and, as in preceding years, the red scale [*Chrysomphalus aurantii*]

was the main source of trouble. It was feared that the unusually wet summer would have increased scale infestation in the summer rainfall area, but in Natal the excessive rainfall seemed to produce less favourable scale conditions than those in the average season. Quarantines were placed on 11 nurseries owing to the presence of *C. aurantii*, on 2 owing to pernicious scale [*Aspidiotus perniciosus*] and 2 others owing to woolly aphis [*Eriosoma lanigerum*]. It is suggested that if any nursery has had a quarantine placed on any part of it for two seasons in succession, the fact should be advertised by the Department of Agriculture in the Government Gazette. The fumigation of woody plants with hydrocyanic acid gas is one of the conditions of their introduction, and regulations restrict the importations to a limited number of a given variety. With a few exceptions, all varieties of ornamental trees and shrubs are admissable. Owing to the danger of introduction of new pests by this means it is regretted that ornamental trees cannot be further restricted, but the result would probably be a serious diminution in the planting of these, which are required in great numbers in South Africa. With fruit trees, the necessity for importation of further stocks is open to question. At present the admission of pear, plum, cherry and almond stocks is unlimited.

Pests intercepted during the inspection of fruit tree stocks comprised several species of Aphids, including the pear root aphis [*Eriosoma pyricola*], which is now attracting serious attention in California; several species of scale-insects, including *Aspidiotus pyri*, *Lepidosaphes ulmi*, and *Pulvinaria betulae*, none of which has yet occurred in South Africa; and many cocoons of unidentified moths and a few clusters of moth eggs. Date palms from Algeria were heavily infested with *Parlatoria blanchardi*, a serious pest that must be prevented from entering the country. As the palms were desirable, they were subjected to prolonged fumigation and planted in quarantine.

European foul-brood of bees, which had hitherto been kept out of South Africa, was discovered during the year in several districts. The question of Government regulations for the suppression of the disease is being considered. The author of the present report is of opinion that legislative measures would be of little value in the present state of the industry of beekeeping. He advocates in preference the adoption by the Department of an active policy of itinerant instruction to encourage beekeeping and spread a knowledge of proper methods for combating bee diseases and pests. After such work was well established, compulsory legislative measures would be open to fewer objections.

San José scale [*Aspidiotus perniciosus*], while still restricted to certain localities, is spreading a good deal in those areas. In and around Pretoria it has increased greatly in the last few years, following a succession of seasons when it made little progress. Its spread is probably in a large measure due to birds; stretches of several hundred yards of grass land have been crossed by it in several districts; in another the scale has spread from a town two miles distant, apparently by the agency of birds. At Johannesburg the scale is being held in check by winter spraying with miscible oil.

The red locust (*Schistocerca septemfasciata*), as in the previous year, gave no trouble either in the Union of S. Africa or in the adjacent

territories. For the past eight years no swarms have been reported, and only a few solitary individuals have been captured in scattered localities. The brown locust (*Locusta pardalina*) continued to be highly troublesome, and its suppression was the outstanding administrative work of the year. The experience of recent years has shown that the long prevalent idea that outbreaks of this species originate from the migration of parent swarms from the Kalahari desert is a mistaken one. They undoubtedly come from individuals breeding within long-occupied parts of the country. The indications are that this locust is always present more or less over a great part of the Union as separate individuals or in small clusters. In this state it is quite impossible to combat it, and it frequently goes unrecognised owing to its lacking in some degree the coloration and markings that distinguish the swarming insect. The gradual formation of swarms from these individuals has previously been described [see this *Review*, Ser. A, vi, p. 359], and such swarms being expected in the season 1916–1917, a circular was issued in August naming the districts where outbreaks were expected. These all become infested, and much more heavily than was anticipated. A table shows the distribution of the pest and the extent of the operations against it. Roughly, about 200,000 square miles were infested to a greater or less degree. The poison used was the same as in the previous year [*loc. cit.*], and the method of its free distribution and use is described. The results as regards locust destruction were gratifying, as comparatively few swarms seem to have escaped. The idea that has long prevailed that winter rains cause rotting of the eggs has proved to be a fallacy. There were two principal areas of infestation, one covering Beaufort West and part of Murraysburg, the other a northern area on both sides of the Orange Free State and Griqualand West border. Hatching in the latter area began in mid-September, without the occurrence of any spring rains, the egg development proceeding from unseasonable general rains that fell in July. In the main northern area very little rain fell through the spring and early summer, and the winter rains not having sufficed to moisten all the eggs, the hatching was prolonged into December and January. The insects of the main hatching that escaped destruction became winged and began to migrate in the middle of November; in the last week of November a number of large swarms left both the southern and northern areas, the general direction of flight being towards Basutoland, into which several swarms penetrated. These migrating swarms could not be traced back to definite localities and it was impossible to fix responsibility for their escape. The majority of the hatchings in Bushmanland followed midsummer rains and are supposed to have come from over-wintering eggs that failed to develop under the influence of the winter rains. Locust flies [*Wohlfahrtia brunnipalpis*] were rare during the season and few locust birds appeared until the locusts had been flying for several weeks. In January and February, however, enormous numbers of birds, chiefly white storks and locust hawks, were present in the northern area and the almost entire absence of trouble from locusts later in the season in this part of the Union is attributed very largely to them. In other localities the wattled starling was reported, but was not very abundant; the small migratory locust bird (*Glareola*) was reported definitely from only a few localities. On the whole, locust birds are

thought to have been more plentiful than in any other season since the present locust cycle began five years ago.

The damage done to standing crops by the locusts is considered to have been slight. A few fields of wheat and other cereals were destroyed, but these were exceptional cases. A far more important loss was that of stock becoming poisoned. The farm value of animals alleged to have been fatally poisoned is estimated at about £3,300, and further loss was incurred through animals being made seriously ill for a time. While in theory no loss of stock should occur in this connection if simple precautions are taken, in practice an occasional loss through accident or mischance must be expected, and such loss must be regarded as part of the cost of fighting the locust invasions. At present the Government assumes no responsibility whatever for any losses, but in view of the gravity of the loss in the season under review, the author has recommended that sufferers should receive some compensation. The importance of poisoning the locusts early in their existence, when the risk to stock is trifling, is pointed out, and also the necessity for safe disposal of empty poison drums. The South African Agricultural Union in January adopted a resolution that the present locust law was considered to work unfairly and to place a heavy burden on a section of the farming community where the outbreak first occurred, that section having to bear the brunt of work and expenditure connected with locust extermination, and urged the Government to provide labour, under an inspector, to assist in the destruction of locusts. The author however. considers that it would be a mistake to remove the responsibility from the occupier or to provide labour until he has reached the limits of his own resources, but he acknowledges that the burden on the occupier of pastoral farms is too heavy and suggests further assistance after losses have occurred and further Government measures to secure the destruction of swarms to the fullest extent practicable by the occupier of the farms on which they first appear. The total Government expenditure for the season's operations was approximately £15,000, while the total cost to the country is reckoned at about £27,000.

Special investigations were carried out on insects injurious to the wattle, which is widely cultivated in Natal for tan bark. It was proved that the chief pest, the bagworm [*Chalioides junodi*], is controllable by dusting the infested trees with powdered arsenical insecticides diluted with finely powdered lime. This is a troublesome remedy, but in view of the lack of natural parasites or of the prospect of increasing the efficiency of those that are present, or of introducing better ones, the practice of dusting should be developed. Continued attention has been given to the problem of combating the maize stalk borer (*Busseola fusca*, Hmps.). Other insects dealt with during the year include pea and bean weevils. Winter spraying against *Pseudococcinella sexvittata* (olive leaf beetle) resulted in the trees being practically free from the pest through the spring and summer. *Blissus diplopterus* (South African grain bug) caused considerable loss of wheat, oats and barley in some districts. There is only one generation in a year; the mature insects shelter in the bark of trees, in cracks in fencing posts, dry maize stalks, etc. from midsummer onwards, and in winter migrate to the grain fields. In July and early August the insects were on the wing in great abundance; the plants are most

heavily damaged while the ears are forming, hence very early sowing, especially of wheat, is advised, so that the plants may be well past the most vulnerable stage before the attack is at its worst. *Antestia variegata* is troublesome to fruit-growers owing to the deformation caused to peaches, but, apparently owing to an egg-parasite, the pest was less in evidence than usual in the season under review. This bug is very partial to *Psoralea pinnata*, a native bush, and it is thought that this plant might prove useful as a trap. The Lamellicorn beetle, *Heteronychus arator*, *Iridomyrmex humilis* (Argentine ant) and *Pseudococcus capensis* (vine mealy-bug) have also received attention during the year. Further studies have been made on the false codling moth, *Argyroploce* [*leucotreta*], and on *Strophosomus amplicollis*, a weevil that for several years has seriously interfered with the growing of maize, cotton and sunflowers. The pustular oak scale [*Asterolecanium variolosum*] is an important pest of the common oak and has spread considerably in recent years. A parasite is exercising considerable control at the Cape, but is apparently absent from the Transvaal, where it is hoped to establish it.

FRAYMOUTH (W. A.). **An Improved Method of Cultivating Lac.**—*Indian Forester, Allahabad*, xlv, no. 2, February 1919, pp. 74–79.

The lac insect [*Tachardia lacca*] is subject to periods of intensive reproduction, which are always followed by others during which its numbers are greatly reduced from various causes, so that during the past 40 years there have been periodic rises and falls in the shellac market, repeated every 7 years or so. These fluctuations are due to the irregular way in which the insect either swarms vigorously or fails to reproduce itself, accentuated by the habits of the lac collector. [See this *Review*, Ser. A, vi, p. 513.]

The first principle to be observed in an improved method of lac cultivation is the non-removal of lac before it has yielded its swarm of larvae to other branches of the trees. The food-plant and climate best suited to the cultivation of commercial lac are the ghont (*Zizyphus xylopyra*) in the forests of Damoh, Saugor, Jabalpur and Central India. These trees require no extensive pruning, and it is only necessary to throw a piece of brood-lac on to the crown of the tree to find that the larvae will drop on to the whole of the lower branches. The swarming occurs in mid-July and in mid-November and usually lasts 3 weeks. It being most necessary to prevent theft during the months of May, June and July, all stick-lac should be cut out and taken away from distant and inaccessible jungles so that the work may be concentrated in those areas which are accessible and easy to supervise. At the end of June all branches that carry lac should be cut off and thrown on the top of other ghont trees and allowed to remain there while they yield their swarm, it being essential that the whole of the lac should be cut and spread. This general cutting of the branches affords the necessary amount of pruning to the trees.

After the swarming in early August as much as possible of the sticks covered with empty lac are collected and the lac is scraped off, dried and cleaned from sand and dust. If labour is not available, however, the whole of this spring crop may be left on the trees till the cold season swarm appears, the lac being then cleaned and bleached

by the rain and sun. At the end of October the process of cutting and distributing the lac-bearing branches should be repeated, distribution being made especially on those trees which, having been cut in July, now have fresh growth. As soon as the winter crop has yielded some of its swarm to the trees it is collected and scraped free from the empty lac. This method aims at using the spring crop particularly as a seed crop, although all the empty cells of resin that can be got are collected, while the winter crop is used as a commercial crop, the great advantage of this routine being that it is always easy to arrange for labour in October and November, and the lac is thus handled and transported in the cold weather, with the result that it is not spoilt by rain.

FRENCH (C. Junr.). **The Passion Vine Longicorn Beetle (*Monohammus fistulator*).**—*Jl. Agric., Victoria,* xvii, no. 2, February 1919, pp. 117-119, 4 figs.

In Victoria *Monochamus* (*Monohammus*) *fistulator* is usually found on *Cassinia aculeata* and *Helichrysum ferrugineum* in the summer months, in which it probably breeds. A description of the various stages is given. As this beetle may easily spread to cultivated plants, spraying passion vines immediately the beetle is seen with the following formula is suggested :—1 lb. of coal tar boiled in 2 gals. water, and from 50 to 100 gals. water added while still hot, this mixture being strained before use [see also this *Review,* Ser. A, vii, p. 201].

COTTON (R. T.). **Insects attacking Vegetables in Porto Rico.**—*Jl. Dept. Agric. Porto Rico, Rio Piedras,* ii, no. 4, October 1918, pp. 265-313, 44 figs. [Received 12th April 1919.]

Particulars are given of a large number of vegetable pests with the usual remedial measures. Among the insects mentioned are *Scapteriscus vicinus* (mole-cricket), and *Amphiacusta caribbea* (sick cricket), which are both nocturnal in their habits and feed indiscriminately on all vegetable crops ; *Cerotoma ruficornis* (bean leaf beetle), feeding on the leaves, the eggs being deposited round the roots of the plant and the larvae feeding on them ; *Agromyza jucunda* (bean leaf-miner), which is reduced to a minor pest by a parasite ; and the Pyralid moths, *Nacoleia indicata* (bean leaf-webber) and *Maruca testulalis* (bean pod-borer). The insects attacking beet include *Pachyzancla bipunctalis* (southern beet web-worm), which skeletonises the leaves, its other food-plants being chard and weeds of the genus *Amarantus,* and *Zinckenia fascialis* (small beet web-worm). Cabbage is attacked by *Plutella maculipennis* (diamond-back moth), this pest being at its height during the summer months. *Systena basalis* (flea-beetle) is a very general feeder, but prefers the tender leaves of the carrot, the eggs being laid near the roots on which the larvae feed. *Xylomyges sunia* is a general feeder which is particularly abundant on chard, the eggs of this moth being laid in clusters of two or three hundred on the leaves. Maize is attacked by the Delphacid leaf-hopper, *Peregrinus maidis* ; the Syrphid fly, *Mesograpta* (*Toxomerus*) *polita,* the larvae of which feed on the pollen grains and saccharine cells in the axils of the leaves and pupate between the stalk and leaf-sheath ; and the leaf-miners,

Agromyza parvicornis and *Cerodonta dorsalis*. The Phycitid moth, *Fundella* (*Ballovia*) *cistipennis* (stalk and pod-borer) causes the death of cowpea plants and renders the peas worthless; *Chalcodermus ebeninus* (cowpea pod weevil) lays eggs within the seeds, where the larvae remain until fully grown, when they pupate in the ground. *Diabrotica innuba* (large striped cucumber beetle) feeds chiefly on the flowers of cucumber, squash, and melons. *Acrocercops sanctaecrucis* (egg-plant leaf-miner) often occurs in great numbers, but is kept under control by parasites, other pests of egg-plants being the weevils, *Baris torquata* and *Anthonomus pulicarius*. *Diabrotica graminea* attacks all vegetable crops and is particularly abundant on flowers, especially those of okra. *Pycnoderes incurvus* (small black squash bug) feeds in all stages on squash and melon vines, eggs being inserted into the stems and larger veins of the leaves, and the nymphs feeding on the underside of the foliage. The foliage of sweet potatoes is attacked by a Cassidid beetle, *Coptocycla signifera*, and *Pilocrosis tripunctata* (sweet potato webworm); that of tomatoes by the caterpillars of *Phytometra* (*Plusia*) *rogationis* and a bug, *Dicyphus prasinus*, which inserts its eggs singly in the midrib of the leaf.

The Ceylon Agricultural Society Year Book, 1919-1920.—*Colombo*, 1919, 149 pp. [Received 16th April 1919.]

A list is given of the common pests of food crops in Ceylon with notes on remedial measures. These include a Noctuid, *Spodoptera mauritia*, Boisd. [see this *Review*, Ser. A, v, p. 500] and a Coreid, *Leptocorisa varicornis* (rice-bug), which does great damage to local crops, feeding on the sap of flowering shoots of grasses, and, in paddy, on the tender developing grain. The eggs are laid on the leaves in clusters or rows, and hatch in 6 to 8 days, the nymphal stage occupying about 18 days, during which four moults occur and wings are gradually developed. Adults have been kept alive in captivity for three months. There are apparently five generations; with the advent of cool weather the insect leaves the open field and goes into the denser shelter of uncultivated land. In all probability breeding ceases until the following rains. Insect enemies of *L. varicornis* include a tiger-beetle, *Cicindela sexpunctata*, L., which flies in the rice-fields from August to October and destroys numbers of the bugs, and an unidentified egg-parasite. Various remedial measures are suggested, the most successful being the use of a bag trap [see this *Review*, Ser. A, vi, p. 186].

Notes are also given on apiculture, sericulture and the culture of the lac insect [*Tachardia lacca*].

Feytaud (J.). **L'Hiver et les Insectes.**—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xviii, no. 1–2, January–February 1919, pp. 4–15.

It is a popular belief among agriculturists that a severe winter destroys the insect pests of plants, and that during the ensuing season the damage due to them will be slight. As a matter of fact this is not the case, hibernating phytophagous insects being able to withstand prolonged exposure to extremely low temperatures without injury. On the other hand predatory insects are not thus immune;

and in destroying them a severe winter exercises a distinctly harmful influence. It is only late frosts that check insect pests, but this gain is more than counterbalanced by the injury to the plants themselves. The author reviews the exceptionally severe winters of 1911, 1914, 1917 and 1918 and shows how, in every case, they were followed by unusual outbreaks of the common insect pests.

DEN DOOP (J. E. A.). **Bestrijding der Tabaksluis in Deli.** [Measures against the Tobacco Aphis in Deli.]—*Meded. Deli Proefstation, Medan*, 2nd series, no. 3, 1919, pp. 1–6. [Received 10th April 1919.]

In Deli, Sumatra, *Myzus* (*Myzoides*) *persicae*, Sülz., is chiefly found at the higher altitudes. The weather also has an important effect on its incidence, the main injury taking place during a prolonged dry spell. Infestation occurs in circular or elliptical patches that spread from the centre. The few alate individuals are chiefly responsible for this extension, and also for the formation of new centres of infestation. The Aphids avoid the sun and are found on the under side of the leaves only, being therefore unable to withstand a driving rain, which turns the leaves over and exposes the under-side. The best method of combating *M. persicae* consequently consists in treating the plants with a spray having the characteristics of driving rain. To attain this a pressure sprayer is necessary and in order to obtain a very coarse jet the resistance at the spray-nozzle must be diminished by increasing the diameter of the perforations in the rose and by boring them in as thin a plate as possible. A thickness of 0·2 mm. [$\frac{1}{25}$ inch] was found suitable. The jet must be fan-shaped, flat, and powerful. It is directed to the lowest part of the mass of foliage and moved upwards, when the leaves will be turned over and washed clean. A soap solution, containing soft soap 1 lb. and water (preferably boiled) 2 gals., is recommended; if water only is used some of the Aphids escape. There is little danger of re-infestation by individuals that fall unhurt to the ground.

DEN DOOP (J. E. A.). **Aanteekeningen over de *Lasioderma* Bestrijding.** [Notes on combating *Lasioderma*.]—*Meded. Deli Proefstation, Medan*, 2nd Series, no. 3, 1919, pp. 7–18. [Received 10th April 1919.]

Since De Bussy published his paper on *Lasioderma serricorne* in Sumatra [see this *Review*, Ser. A, v, p. 583] the position has been modified in several respects, one of the most important being that the chief infestation now occurs in baled tobacco and not in the sorting piles. This is due to prolonged storage consequent on lack of shipping facilities. The presence of *L. serricorne* may be ascertained without opening the bales, for the beetles creep out of the bales in which their development has occurred. A very careful inspection of the unopened bales is therefore sufficient. If no beetles are found, it is clear that no damage has been done and if only a few individuals (up to about 20) per day are discovered the total injury may be dismissed as negligible. If the bales in and near which most of the beetles are found be marked, it increases the chances of discovering the centre of

infestation. Where search for infestation by the tobacco moth [*Setomorpha margalaestriata*] is also required, only the lower bales, *i.e.*, those most exposed to damp, need be opened. Any matting under the bales, or cover over them, must be carefully examined, the latter before the bales themselves are inspected. Infested tobacco must be fumigated with carbon bisulphide without delay. A daily search is necessary and usually a rapid increase in the number of beetles emerging from the bales will be noticed. Such collection prevents beetles that have emerged from tobacco subsequently removed for fumigation from flying to the fermenting shed and other non-disinfected places.

It is important that the tobacco of two different harvests should not be kept together in a given fermenting shed. Bales should only be opened in a chamber arranged for disinfection and capable of being properly closed. If this is not possible, opening must be done at least $\frac{3}{4}$ mile from dwellings. All baled tobacco must be inspected as described above.

In previous communications [see this *Review*, Ser. A, v, p. 417, 583; vi, p. 231] it was stated that caraway seed (*Carum carui*) was infested by *L. serricorne*; this has been found to be incorrect and wherever *Carum carui* was mentioned, *Cuminum cyminum* (cummin) should be read.

DEN DOOP (J. E. A.). **Een en ander over de "Groene Capside."** [Notes on the "Green Capsid," *Gallobelicus nicotianae*, Koningsberger.]—*Meded. Deli Proefstation, Medan*, 2nd Series, no. 3, 1919, pp. 19–20.

This preliminary note is issued as a result of the study in 1918 of the life-history of *Gallobelicus nicotianae*, which occurs in British India, Ceylon, Java and Sumatra. On the east coast of Sumatra it is found wherever tobacco is grown, but is more abundant in high situations. The female oviposits in the leaves, and the entire life-cycle from the egg to the death of the adult lasts 25–30 days. The greatest injury occurs at the time that the plants have about ten leaves. Up to the present no useful method of checking this pest has been found, sprays that kill the Capsid also injuring the plant.

BRÈTHES (J.). **La Babosita de los Perales:** *Caliroa* (*Eriocampoides*) *limacina*, **Retz.** [The Pear Slug, *Eriocampoides limacina*].—*Anales Soc. Rural Argentina, Buenos Aires*, liii, no. 1, January 1919, pp. 15–17, 2 figs.

Pear trees in Argentina are considerably damaged by this sawfly, which also attacks cherry, plum, rose, *Crataegus* and other allied plants. The larval stage lasts about three weeks, during which four moults occur. The damage is done by the larvae in Argentina during December and January, pupation taking place in the ground and the adults beginning to appear in October. Spraying with 4 lb. lead arsenate to 40 gallons of water kills upwards of 90 per cent. of the larvae. Dusting with sulphur has also been found an effective remedy.

Porter (C. E.). **Notas breves de Entomologia agrícola.** [Brief Notes regarding Agricultural Entomology.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 4, 31st December 1917, pp. 53-54. [Received 12th April 1919.]

Orgyia (*Notolophus*) *antiqua* is recorded as doing considerable damage to the leaves and young fruit of apples. The Ptinid beetle, *Calymmoderus capucinus*, Sol., is recorded in oak furniture, the wood being perforated with its galleries.

Figueroa (C. S.). **La** *Macromphalia dedecora* **y sus Parasitos.** [*Macromphalia dedecora* and its Parasites.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 4, 31st December 1917, pp. 55-71, 4 plates, 6 figs. [Received 12th April 1919.]

The caterpillars of the Lasiocampid moth, *Macromphalia dedecora*, are abundant on cypresses, casuarinas and pimento in the public parks of Santiago, and in smaller numbers on other garden and orchard plants, such as lilies and damsons, and if it were not for certain parasitic enemies, would undoubtedly become a serious pest.

The parasites that limit the abundance of *M. dedecora* include the Ichneumonid, *Cryptus horsti*, Brèthes, which is a formidable enemy of the larvae. Another larval parasite here described is *Apanteles macromphaliae*, sp .n. This is an even more important parasite than *C. horsti*, and has two generations a year; the first appears about the end of April, issuing from larvae of *M. dedecora*, and the second emerges about the end of October from cocoons of *M. dedecora* and parasitises the larvae of *Dirphia amphimone*, being thus enabled to survive until the spring, when it can again attack *M. dedecora*.

Parasites of the eggs of *M. dedecora* include the Chalcidids, *Calosoter silvai*, Brèthes, *Aprostocerus norax*, Wlk., and *Dirphiphagus ancilla*, Wlk.

Lizer (C.). **Sobre la Presencia en Argentina de un Psílido exótico** (*Trioza alacris*, **F.**). [The Presence in Argentina of an exotic Psyllid (*Trioza alacris*, F.).]—*Anales Zool. Aplicada, Santiago de Chile*, v, no. 1, 30th April 1918, pp. 16-21, 1 plate, 3 figs. [Received 12th April 1919.]

Investigations are being made on *Trioza alacris*, F., which was observed in February in the town of Buenos Aires on laurel (*Laurus nobilis*), this being apparently its only food-plant. The life-history of the insect has not yet been worked out, but descriptions are given of the various stages to assist in its identification. The larvae and nymphs make numerous punctures in the laurel leaves and cause them to curl and turn yellow, the insects sheltering in the curled leaves under a sticky, wax-like secretion. The larvae of a Dipteron, probably a Syrphid, have been observed in company with the early stages of *T. alacris*.

Bruch (C.). **Notas Biologicas sobre** *Endoxyla strigillata*, **Feld.** [Biological Notes on *Endoxyla strigillata*, Feld.]—*Anales Zool. Aplicada, Santiago de Chile*, v, no. 1, 30th April 1918, pp. 21-30, 3 plates, 3 figs. [Received 12th April 1919.]

The caterpillars of this Cossid moth are recorded as tunnelling in willows in La Plata. They infest the trunks and main branches,

in which they construct longitudinal galleries. The eggs are laid in crevices in the bark, generally in the axils of the branches. The larvae hatch in 15 days and at once begin to produce small cavities which they extend into the wood and prolong into galleries running upwards and then outwards again to the bark. The length of the larval stage is not definitely known, but in all probability the entire life-cycle is completed within a year. Pupation occurs in the upper part of the gallery, which is previously plugged up with sawdust and larval excrement, and the pupa is pushed halfway out of the trunk before the adult makes its escape.

PORTER (C. E.). **Materiales para la Entomología Económica de Chile.** —*Anales Zool. Aplicada, Santiago de Chile*, v, no. 1, 30th April 1918, pp. 31–33, 3 figs.

Heliothis (*Chloridea*) *obsoleta* is recorded as infesting pea-pods (*Pisum sativum*); this is the first time this moth has been reported from the south of Chile.

Apanteles riverae, Porter, previously described as a parasite of *Orgyia* (*Notolophus*) *antiqua*, is now recorded as parasitic upon the larvae of the Sphingid, *Protoparce sexta caestri*.

DE LA ESCALERA (M. M.). **Ipidos (Scolytidos) observados en la Peninsula Ibérica, Marruecos y Canarias.** [Ipids (Scolytids) observed in the Spanish Peninsula, Morocco and the Canary Islands.]—*Bol. R. Soc. Espa˜ola Hist. Nat., Madrid*, xix, no. 2, February 1919, pp. 103–108.

Among the 63 species of Scolytids recorded in this list is *Myelophilus piniperda*, L., var. *pallidus*, nov., which is distinguished as a sub-species largely on its uniform yellow colour. It has been taken on *Pinus halepensis* in Cuenca and other localities in Spain.

AULLÓ (M.). **Observaciones sobre la Variedad *pallidus*, establecida por D. M. M. de la Escalera en la especie *Myelophilus piniperda*, L.** [Observations on the Variety *pallidus* of *Myelophilus piniperda* established by Don M. M. de la Escalera.]—*Bol. R. Soc. Española Hist. Nat., Madrid*, xix, no. 3, March 1919, pp. 146–147.

Referring to the variety recorded in the preceding paper, the author points out that observation of this beetle in Murcia and elsewhere, where it occurs on *Pinus halepensis*, shows that yellow-coloured individuals are always found under the bark while those captured in the buds after hibernating and shortly before reproduction, as well as in the egg-galleries, always exhibit the dark coloration of the adult stage. The same observation applies to individuals taken on *Pinus pinaster* in Asturias. It is not considered therefore that the characteristic of the yellow colouring upon which the new variety is chiefly based is sufficient to justify its establishment.

DE MEIJERE (J. L. F.). **Welk Voedsel eet de Roek het liefst?** [What is the favourite Food of the Rook?]—*Tijdschr. Plantenziekten, Wageningen*, xxv, no. 2, March 1919, pp. 53–62.

The conclusion is reached that on the whole the rook must be held to be a useful bird and should be protected, as is indeed required by law in Holland.

In a criticism of this paper Dr. J. Ritzema Bos differs from the author on many points, but agrees that the balance must be struck in favour of the rook. In certain cases, however, it is very necessary that crops should be protected against this bird.

RUGGLES (A. G.) & GRAHAM (S. A.). **Garden and Small Fruit Insects with Notes on Spraying in general.**—*Minnesota Univ. Farm, St. Paul*, Spec. Bull. no. 29, July 1918, 31 pp., 50 figs. [Received 16th April 1919.]

The information contained in this bulletin has already been noticed [see this *Review*, Ser. A, vi, p. 370].

MATZ (J.). **Diseases and Insect Pests of the Pecan.**—*Florida Univ. Agric. Expt. Sta., Gainesville*, Bull. no. 147, May 1918, pp. 135–163, 28 figs. [Received 15th April 1919.]

The insect pests of pecan mentioned in this bulletin have already been noticed at length [see this *Review*, Ser. A, vi, pp. 168, 226].

GARMAN (P.). **A Comparison of Several Species of Lepidoptera infesting Peach and Apple in Maryland, with Additional Notes on the Oriental Peach Moth.**—*Maryland Agric. Expt. Sta., College Park*, Bull. no. 223, October 1918, pp. 103–126, 35 figs. [Received 16th April 1919.]

In consequence of many enquiries regarding *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth), it has been thought advisable to make a comparison of that imported and little known pest with the native, more widely distributed and better known Lepidopterous pests. A table is given comparing the life-history, habits, nature of injury and food-plants of *C. molesta*, *C. pomonella*, *C. prunivora*, *Enarmonia pyricolana*, *Eucosma* (*Tmetocera*) *ocellana* and *Anarsia lineatella*, with a key differentiating the larvae, pupae and adults of each species. Detailed notes on the life-history and habits of *C. molesta* are added.

HEADLEE (T. J.). **Some Important Orchard Plant Lice.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Bull. no. 328, 15th February 1918, 27 pp., 6 figs.

The conclusions drawn from a number of experiments with insecticides against *Aphis pomi*, De G., *A. sorbi*, Kalt., *A. bakeri*, Cow., and *Siphonaphis padi*, L. (*Siphocoryne avenae*, F.) are that the most practical treatment is the application of winter strength lime-sulphur, with the addition of 40 per cent. nicotine at the rate of 1 : 500, during the stage when the buds are green. At that time the maximum number of Aphids will be hatched and will be killed by the nicotine, and

the unhatched eggs will be in their most sensitive state and will also be destroyed. Preparations should be made for treatment if any eggs are seen, even though weather or natural enemies may prove sufficient to check an outbreak. The destruction of returning migrants and egg-laying individuals is considered impracticable owing to the number of sprayings that would be necessary. Destruction of the eggs in the dormant season cannot in the present state of knowledge be relied upon, while treatment is difficult after the leaves have unfolded owing to the shelter they afford to the Aphids.

WEISS (H. B.). **Some New Insect Enemies of Greenhouse and Ornamental Plants in New Jersey.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Circ. no. 100, 1st November 1918, 19 pp., 32 figs. [Received 16th April 1919.]

Neoborus amoenus, Reut. (ash leaf bug) has a wide distribution in New Jersey, where it is found on white ash (*Fraxinus americana*), green ash (*F. lanceolata*), red ash (*F. pennsylvanica*) and the English ash (*F. excelsior* var. *pendula*). The eggs, laid on the underside of young leaves, hatch in from 10 to 14 days and there are 5 nymphal stages. Adults appear about mid-July and a second generation in the latter part of August. Both adults and nymphs feed on the underside of the leaves, on which white spots appear, the foliage becoming somewhat dry and curled. Apparently no attempts have been made in New Jersey to control the species by insecticides.

Leptobyrsa rhododendri, Horv. (*explanata*, Heid.) (rhododendron lace bug) occurs on *Rhododendron maximum* and mountain laurel (*Kalmia latifolia*). There are probably two generations in New Jersey. Hibernation occurs in the egg-stage, nymphs appearing in early May and adults by mid-June. Eggs of the next generation are laid in June and July, the second generation of adults appearing in August. Mottling of the leaves is caused by the feeding of the nymphs and adults. These may be controlled by a spray of 6 or 7 lb. whale-oil soap to 50 U.S. gals. water, directed against the underside of the leaves and applied as soon as the nymphs are noticed.

A number of other recent nursery pests in New Jersey are also mentioned [see this *Review*, Ser. A, v, pp. 140, 221, 238, etc.].

HEADLEE (T. J.). **The Angoumois Grain Moth.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Circ. no. 92, 20th October 1917, 3 pp., 1 fig. [Received 16th April 1919.]

An account is given of the Angoumois grain moth [*Sitotroga cerealella*] with its life-history, depredations, and the usual methods for its destruction in stored grain, including fumigation, heat and removal of moisture.

HEADLEE (T. J.). **The Bean Weevils.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Circ. no. 91, 20th October 1917, 6 pp., 3 figs. [Received 16th April 1919.]

The bean Bruchids, *Bruchus obtectus*, Say, *B. chinensis*, L., *B. quadrimaculatus*, F. and *B. rufimanus*, Boh., are briefly described and their life-history is outlined. The usual remedial measures are advocated.

HEADLEE (T. J.). The Strawberry Weevil (*Anthonomus signatus*, Say). —*New Jersey Agric. Expt. Sta., New Brunswick*, Bull. no. 324, 1st January 1918, 19 pp., 10 figs. [Received 19th April 1919.]

The bulk of the information contained in this bulletin has previously been noticed [see this *Review*, Ser. A, iv, p. 189]. The repellent mixture described consists of 1 part powdered lead arsenate and 5 parts finely ground sulphur. A simple screen wire sifter is recommended for small areas, and power machines for use on large acreages are described and illustrated.

DAVIS (J. J.). Contributions to a Knowledge of the Natural Enemies of *Phyllophaga*.—*State of Illinois Natural History Survey Bulletin, Urbana*, xiii, Article v, February 1919, pp. 53–133, 13 plates, 46 figs.

Life-histories are given of the various parasitic and predaceous insects attacking the Melolonthid beetles of the genus *Lachnosterna* (*Phyllophaga*). Parasites of the larvae include: *Tiphia punctata*, Rob., *T. transversa*, Say, *T. inornata*, Say, and *T. vulgaris*, Rob. These wasps are themselves parasitised by the Bombyliid flies, *Exoprosopa fascipennis*, Say, *E. pueblensis*, Jaenn., *Anthrax parvicornis*, Coq., and a Rhipiphorid beetle, *Macrosiagon pectinatus*, F.

Other Hymenopterous parasites of *Lachnosterna* are: *Elis quinquecincta*, F., *E. atriventris*, Gah., *E. interrupta*, Say, *E. obscura*, F., and *E. illinoisensis*, D.T.

Tachinid and Dexiid parasites include *Microphthalma disjuncta*, Wied., *M. pruinosa*, Coq., *Ptilodexia harpasa*, Wlk., *P. abdominalis*, Desv., *Myocera cremides*, Wlk. ? and *Prosena* (*Mochlosoma*) *lacertosa*, Wulp. Predaceous insect enemies of the larva comprise the larvae of a number of Asilids: *Promachus vertebratus*, Say, *P. fitchi*, O. S., *P. bastardi*, Macq., *Erax maculatus*, Macq., *E. aestuans*, L., *E. cinerascens*, Bell., *Deromyia winthemi*, Wied., *D. discolor*, Lw., *D. umbrina*, Lw., *Asilus paropus*, Wlk., *A. lecythus*, Wlk., *Ceraturgus cruciatus*, Say, *Proctacanthus milberti*, Macq., and *Coenomyia pallida*, Say, and two Tabanid larvae, *Tabanus atratus*, F., and *T. sulcifrons*, Macq.

Among Coleoptera the larvae of the Carabids, *Harpalus pennsylvanicus*, Dej., *H. caliginosus*, F., *Calosoma calidum*, F., *C. scrutator*, F., *C. lugubre* and *Chlaenius tomentosus*, Say, probably all prey upon white grubs. A number of occasional predaceous enemies such as ants, mites and crickets are also mentioned.

Parasites of the beetle are the Ortalid flies, *Pyrgota undata*, Wied., and *P. valida*, Harr., both bred from a large number of species; the Tachinid flies, *Cryptomeigenia theutis*, Wlk., *C. aurifacies*, Walt., *Eutrixoides jonesi*, Walt., *Eutrixa masuria*, Wlk. (*exilis*, Coq.) and *Biomyia lachnosternae*, Towns.

The following have also been recorded, but their value as enemies is doubtful: *Sarcophaga prohibita*, Ald., *S. tuberosa* Pand., var. *sarraceniodes*, Ald., *S. cimbicis*, Towns., *S. helicis*, Towns., *S. utilis*, Ald., *S. falculata*, Pand., and possibly *Fannia canicularis*, L. Spider enemies include *Lycosa helluo*, Wakn., *Xysticus gulosus*, Keys, and *Plectana stellata*, Hentz.

Particulars are also given of diseases caused in white grubs by Nematodes, Protozoa, bacteria and fungi, with a list of the birds, mammals and Amphibia that prey upon them.

BALLOU (H. A.). **Miscellaneous Insects.**—*Agric. News, Barbados,* xviii, no. 440, 8th March 1919, p. 74.

Insect pests from the West Indies, recently identified, include a grasshopper, *Turpilia punctata,* from St. Lucia, reported to eat the leaves of citrus trees; a Capsid bug, *Paracarnus* sp., a natural enemy of the cacao thrips [*Heliothrips rubrocinctus*], although there is so far no evidence of its value as such; another bug, *Anasa scorbutica,* from St. Vincent and Grenada on *Momordica charantia*; the Membracid, *Enchenopa auropicta,* taken in St. Vincent on *Tephrosia candida*; and a beetle, *Araecerus fasciculatus,* de G., found in abundance in the hold of a ship laden with cassava and cotton seed. During November 1918, there were severe attacks of caterpillars on cowpeas and pigeon peas in Antigua and St. Kitts, but these outbreaks were materially checked by a parasite, since identified as *Coelichneumon serricorne,* Cress.

SKAIFE (S. H.). **Pea and Bean Weevils.**—*Union of S. Africa Dept. Agric., Pretoria,* Bull. no. 12, 13th September 1918, 32 pp., 17 figs. [Received 10th April 1919.]

There are five species of Bruchids infesting cultivated peas and beans in South Africa, all of them having been introduced, viz. :—*Bruchus pisorum* (pea weevil), *B. rufimanus* (red-footed bean weevil), *B. obtectus* (bean weevil), *B. chinensis* (cowpea weevil) and *B. quadrimaculatus* (four-spotted weevil). In addition to these, *Spermophagus pectoralis* (Mexican bean weevil) has been found in beans from Mozambique and *B. rufipes* has occurred in vetch seed imported from Europe.

B. pisorum, L., is at present limited in South Africa to the south-western districts of the Cape Province, where, in some places, its depredations are extremely severe. The adults appear during spring and the females oviposit on the exterior of the green pods. The eggs hatch in about 3 weeks during spring, but take nearly twice as long during the cold winter months, whilst in November and December they take only 16–18 days. The adults remain inside the peas for an indefinite period. It was found that beetles began to emerge in January from some peas collected at the end of the previous November, and removed from their pods; emergence continued at intervals until the following September, the great majority emerging during June, July and August. Another lot of peas, gathered at the same time were left in their pods and the majority of these did not open spontaneously. Between January and August pods contained adults that had made no attempt to bore their way out, while from August onwards dead as well as living weevils were found when the pods were opened. Infested peas intended for planting may be soaked for 5 minutes in a mixture of 2 parts of boiling water to 1 of cold without being injured, the resulting temperature of the mixture being about 75° C. (167° F.). These proportions must be strictly adhered to, and the quantity of water used must be considerably in excess of the bulk of the seed treated. The exposure of infested peas to the heat of the sun is a useless measure under the conditions prevailing at the Cape in early summer. By covering the trays with sheets of glass, however, a maximum temperature of 63° C. (145° F.) may be reached, and this

is sufficient to kill all the larvae after an exposure of one day. Other means of destroying this pest with carbon bisulphide or exposure to dry heat have already been noticed [see this *Review*, Ser. A, vi, pp. 329, 465]. Late planting with a view to preventing infestation has not been found successful, the greater freedom from weevils being counteracted by the fact that the crop gets rapidly poorer as the summer advances, as well as being severely damaged by the caterpillars of small Lycaenid butterflies.

B. rufimanus, Boh., has hitherto been recorded in South Africa only from the Cape Peninsula, breeding in broad beans, tick beans and horse beans. The adults appear in September and may be found up to the middle of December. The eggs are deposited on the green pods and take from 16 to 24 days to hatch. The larva takes 5 or 6 months to develop, and more than one can reach maturity in a single seed. The adults begin to emerge towards the end of February and continue to do so at intervals until September; the majority appear on warm days in autumn and winter, this species being more intolerant of cold than *B. pisorum*. Measures recommended for *B. pisorum* apply equally well to *B. rufimanus*, but in using the hot-water remedy beans must be immersed for 10 minutes owing to the thickness of their integument.

B. obtectus, Say, has a wide distribution in South Africa, infestation being heaviest in the Eastern Province. The adults appear during January and are found throughout the rest of the summer. The eggs are not deposited, as has been stated, inside the green pods, but inside the dry, ripe pods. The eggs hatch in from 10–13 days in the height of summer, and in from 20–24 during winter. More than one larva can reach maturity in a single bean, the process occupying 3–4 weeks during summer, and 6–8 weeks in winter. The pupal stage lasts some 8–11 days in summer and some 18–25 days in winter. The adults remain in their cells only a few days in summer, but the dormant period in the winter depends largely on the weather. Varieties of beans immune to attack by this species are:—*Phaseolus lunatus* (Lima bean), *Vicia faba* (broad bean), *Mucuna pruriens* var. *utilis* (velvet bean) and *Glycine hispida* (soya bean), while *P. vulgaris* (French or kidney bean) and *P. multiflorus* (runner bean) are only injured to a slight extent. *B. obtectus* has some 4 generations a year, that in winter occupying about 4 months, that in summer 2 months, while in spring and autumn a generation takes about 3 months. Since breeding takes place in dry, stored beans, the necessity for treating them as soon as possible after harvesting is obvious. The remedies advised against *B. pisorum* are equally efficacious against *B. obtectus*, and an additional measure, useful in some cases, consists in mixing the beans with an equal volume of dry, finely pulverised soil, ground limestone rock, or air-slaked lime. Beans kept for seed may be protected by soaking them in paraffin for an hour and then spreading them in the sun to dry, 93 per cent. of such seeds germinating after a lapse of 10 months.

B. chinensis, Thunb., is widely spread in South Africa, and is quite common at the Cape, where it appears among cowpeas during February. The eggs are deposited on the outside of the dry, ripe pods and hatch in from 10–21 days, the larval stage lasting some 4 or 5 months during the cold season, but only about 5 weeks in summer. The adults do not lie dormant in their cells for any length of time, but at the Cape

they are active and freely ovipositing all through the winter. All the varieties of cowpeas grown are liable to attack. No Chalcid parasites have been reared from examples bred at the Cape, but the mite, *Pediculoides ventricosus*, Newp., attacks the larvae and pupae, as well as those of *B. pisorum*, *B. obtectus*, and to a small extent of *B. rufimanus*. The adults may be controlled by the use of lime [see this *Review*, Ser. A, v, p. 208].

B. quadrimaculatus, F., has been received from Mozambique, Rhodesia, Johannesburg and Durban, but does not appear to occur at the Cape, being apparently not so common or so hardy as *B. chinensis*. It seems to be able to breed only in seed that is comparatively fresh and that contains a certain amount of moisture. Three different species of Chalcid parasites have been reared from infested cowpeas from Mozambique.

The bulletin concludes with detailed instructions for carbon bisulphide fumigation.

GOWDEY (C. C.). **Annual Report of the Government Entomologist.**—*Uganda Dept. Agric. Ann. Rept. for the Year ending 31st March 1918, Kampala*, 1918, pp. 42–51. [Received 19th April 1919.]

A list of scale-insects attacking coffee is given, together with their other food-plants, *Ceroplastes destructor*, Newst., being the only one to be added to those mentioned in the previous report [see this *Review*, Ser. A, vi, p. 51]. Among Aphids on coffee only *Toxoptera coffeae*, Nietn., was reported; it also occurred on the shade tree *Gliricidia maculata*. The coffee plant bugs include *Lygidocoris mimeticus*, R. & P., reported from two estates only, and *Piezodorus pallescens*, Germ., which causes injuries similar to those of *Antestia lineaticollis*, Stål (*orbitalis*, Westw., var. *faceta*, Germ.). The latter bug did not make its presence felt in Uganda until 1915 since when serious outbreaks have been reported, chiefly on *Coffea arabica*. Eggs are laid on any part of the plant or on fallen leaves, prunings and fruit. Soon after their appearance the nymphs disperse in search of food; they are very rapid in their movements and at the slightest disturbance hide in the axils of the leaves or branches or inside the clusters of berries and curled leaves. As soon as the flowers or fruit are available, the nymphs cluster on them, but they also readily attack the new leaves as they appear, the adults exhibiting the same preference. The eggs are laid in clusters of 7 to 30; these take about 8–12 days to hatch; the first moult takes place in from ten to fourteen days, and there are 5 moults altogether. The complete cycle from egg to death of adult takes 100 days on an average. A table is given showing the duration of the various stages. This bug kills the tender leaves of the tips of the terminal shoots and sucks the newly set as well as the well developed berries, causing them to fall. Other food-plants are *Gliricidia maculata* and the fruit of custard apple and sugar apple. Experiments have been made with various sprays, the formulae for which are given, with the results obtained. Resin wash proved the most effective and was prepared as follows:—6 lb. of resin and 4 lb. caustic soda 92 per cent. are powdered and boiled in 2 gals. water until dissolved, and while still boiling, the mixture is made up slowly to 5 gals. with water; 10 lb. of whale oil soap is dissolved

in 5 gals. hot water, and the two solutions are then mixed and diluted to 45 gals. A Chalcid has been found parasitic on the eggs of *A. lineaticollis*.

No damage has been reported by the caterpillars of *Parasa*, and the decrease of *Metadrepana glauca*, Hmps., was probably due to the unusually prolonged drought from October to March. *Diarthrothrips coffeae*, Will., was reported for the first time as causing serious damage; spraying with kerosene emulsion and destruction of the fallen leaves are recommended as the best remedial measures; another thrips, as yet unidentified, will probably prove difficult to control owing to its habit of concealing itself under the curled margins of the leaves. *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) is decreasing in numbers. The stem borers, *Apate monacha*, F., *A. indistincta*, Murr., and *Dirphya (Nitocris) princeps*, Jord., were reported, a Braconid parasite of the latter being more in evidence than usual. The following bait proved efficacious in combating *Gryllus bimaculatus*, de G., and *Gryllotalpa africana*, P. de B.; 1 lb. Paris Green, 14 lb. flour, 3 lb. jaggery, the juice of 6 lemons and 3 gals. water. Baits proved useless against millipedes attacking newly planted-out coffee, and collecting had to be resorted to.

Among the cacao pests no additions are made to the list of scale-insects; *Toxoptera coffeae*, Nietn. (*theobromae*, Schout.) attacked the flower clusters and under-surface of the young leaves. Over-ripe pods were found infested with larvae of *Ceratitis punctata*, Wied. *Xyleborus camerunus*, Hag., attacks cacao, but causes death only in those plants already infested with the fungus, *Diplodia*. The beetle, *Adoretus hirtellus*, Castn., retards the growth and the caterpillars of the Limacodid, *Parasa vivida*, Wlk., feed on the under-surface of the leaves in colonies; when mature the cocoons of the latter are formed on the trunks of the tree. *Diacrisia maculosa*, Cram., attacks the foliage and *Euproctis mediosquamosa*, B. Bak., the parenchyma of well developed pods, forming corky scars. The Pentatomid bug, *Libyaspis (Plataspis) vermicellaris*, Stål, attacks cacao twigs as well as *Erythrina*. A table is given showing the duration of the stages of *Helopeltis bergrothi*, Reut., var. (cacao mosquito).

Pests of rubber include *Aspidiotus destructor*, Sign. (Bourbon scale), which also occurs on banana, screw-pine, guava and mango; and the Scolytids, *Xyleborus affinis*, Eich., *X. confusus*, Eich., and *X. perforans*, Woll., which attack trees already weakened from some other cause.

Tea suffered from *Aspidiotus transparens*, Green, *Coccus discrepans*, Green, *Helopeltis bergrothi*, Reut., var. and *Gryllotalpa africana*, P. de B., the latter feeding on the roots in the nursery. Cotton was infested by the usual pests including:—*Dysdercus* spp., *Oxycarenus* spp., bollworms and *Leptoglossus membranaceus*, F. (leaf-footed plant bug). The Cetoniid beetle, *Gnathocera trivittata*, Swed., and *Macrosiphum granarium*, Kirby, attacked flowers of wheat, and *Aphis maidis*, Fitch, those of maize. *Gliricidia maculata*, used for shading cacao, was attacked by *Pseudococcus citri*, Risso, *Coccus longulus*, Dougl., and *Toxoptera coffeae*, Nietn., and *Erythrina* by *Aulacaspis chionaspis*, Green.

There were more locust swarms than in the previous year, and they appeared to be much larger.

SPEYER (E. R.). **Committee of Agricultural Experiments. Shot-hole Borer of Tea.**—*Trop. Agriculturist, Peradeniya,* lii, no 2, February 1919, pp. 65–69.

As a remedy against the shot-hole borer of tea [*Xyleborus fornicatus*] an experiment was tried in painting bushes immediately after pruning with the following mixtures :—(a) resin-soap fish-oil emulsion, with excess of resin ; (b) resin-soap fish-oil emulsion ; (c) resin-soap fish-oil kerosene emulsion ; (d) resin-soap kerosene emulsion. An equal number of trees were treated with each mixture between 4th and 10th December 1918 ; when examined a month later the galleries in the areas treated with (a) and (b) were vacant ; in the galleries of plants treated with (c) and (d) a few living beetles were found, but no young stages. The untreated areas contained all stages as well as beetles commencing new galleries. In both areas a number of galleries had been vacated naturally, but among the treated plants even those in process of construction were found empty, so that the insecticidal properties of (a) and (b) are evident. The excess of resin was found unnecessary. The only detrimental effect noticed on the plants was that the growth of new shoots is retarded for about 7–14 days. The efficacy of the mixture as a preventive measure was confirmed by an experiment in the laboratory. It was also ascertained that fish oil, but not kerosene, acts as a definite deterrent. The quantities advised per acre of tea are 27 lb. of the solid emulsion dissolved in 8 gallons of water. When the fields are again in flush the insects, once treated by the above method, may be easily controlled by cutting out the infested branches, but this should not continue after 6 months before the following pruning.

Work connected with Insect and Fungus Pests and their Control.—*Imp. Dept. Agric. West Indies, Report Agric. Dept. Dominica 1917–1918, Barbados,* 1919, pp. 11–17. [Received 21st April 1919.]

At the beginning of 1915 spraying of young lime trees was discontinued to judge the efficacy of natural methods of control ; as a result several species of scale-insects became very abundant and checked the development of the trees ; though spraying was not resumed, the loss occasioned was replaced by the rapid growth due to the remedial measures employed in the form of thorough draining and cultivation and the application of a small quantity of lime and then of organic manure at the rate of 2 lb. per tree. It is considered, therefore, that these measures, accompanied by the provision of a shelter crop such as *Tephrosia candida*, are the best means of protecting young lime trees from infestation by scale-insects.

Puncheons and other packages used for exporting lime juice have been severely attacked by borers belonging to the genus *Xyleborus* and allied genera. Infested timber may be treated by placing it in an air-tight chamber into which steam is forced until a temperature of 118° to 125° F. is reached or by fumigation with carbon bisulphide ; to prevent reinfestation naphthaline should be scattered around the material ; carbolineum should not be used for this purpose as it is liable to taint the lime juice.

The mango crop during 1917 suffered from an abnormal outbreak of a species of fruit-fly not yet identified. The eggs are inserted

into the fruit and the larvae burrow and feed on the interior causing it to drop prematurely; in order to pupate the larvae abandon the fruit and enter the ground near the tree. The only fruit fly so far recorded from Dominica is *Anastrepha acidusa*, which appeared in oranges, mangos and guavas in 1909. As a remedial measure a poisoned bait spray consisting of a mixture of 2½ lb. sugar, 3 to 5 oz. lead arsenate and 4 gals. of water is suggested. This spray would only be practicable on small, grafted mango or guava trees, when the flies are abundant.

Hood (J. D.). **On some new Idolothripidae (Thysanoptera).**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, vii, no. 4–6, April–June 1919, pp. 66–74, 2 plates.

The species dealt with are:—*Ophthalmothrips pomeroyi*, gen. et sp. n., and *Kleothrips atratus*, sp. n., from East Africa; *Gigantothrips crawfordi*, sp. n., from the Philippine Islands; and *Acanthinothrips nigrodentatus*, Karny, inhabiting galls on *Planchonia valida* in Java, for which a new genus, *Cercothrips*, is erected.

Hood (J. D.). **On some new Thysanoptera from Southern India.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, vii, no. 4–6, April–June 1919, pp. 90–103, 4 plates.

The material dealt with in this paper was collected at Coimbatore, and includes:—*Scirtothrips dorsalis*, sp. n., on castor and chillies; *Perissothrips parviceps*, gen. et. sp. n., on *Ailanthus excelsa*; *Rhipiphorothrips cruentatus*, sp. n., on grape vine and *Careya arborea*; *Neoheegeria indica*, sp. n., on *Ailanthus excelsa*; *Arrhenothrips ramakrishnae*, gen. et sp. n., on *Mimusops elengi*; and *Liothrips ordinarius*, sp. n., on *Sesbania grandiflora*.

Gurney (W. B.). **Maize Pests.**—*Agric. Gaz. N.S.W., Sydney*, xxx no. 2, 3rd February 1919, pp. 111–112.

A cutworm is recorded as damaging maize and castor oil seedlings. Experiments were made with four different mixtures for which the formulae are given: the most successful was made as follows:—24 lb. bran were mixed with 1 lb. of Paris green while dry; 1 pint of salt water (3 oz. salt to 3 quarts water) was then added to every 4 lb. of bran to make a slightly damp crumbly mash. After one night's treatment with this, 79 per cent. of the caterpillars were killed. The mash should be distributed in small handfuls at the base of each cluster of seedlings late in the afternoon. The above formula mixed with treacle and water is practically as effective, but seems to dry more rapidly; greater proportions of Paris green were less effective. These quantities are sufficient for half an acre of maize.

Gurney (W. B.). **Control of Grasshopper (Locust) Swarms.**—*Agric. Gaz. N.S.W., Sydney*, xxx, no. 2, 3rd February 1919, pp. 113–120, 3 figs.

The grasshopper, *Chortoicetes terminifera*, Wlk., is generally destructive for two successive seasons and then may not appear in large numbers for from 6 to 10 years; it is also known from Queensland,

Victoria and South Australia. There are two generations each summer, sometimes three, the overwintering eggs usually hatching in September. The eggs are laid in the ground; for this purpose a swarm masses together and settles for a day or two on a bare or thinly grass-covered area. In the summer the eggs hatch in 3 weeks. A description of the immature stage is given; this lasts about seven weeks and during that time there are five moults; the adult lives for several weeks.

Fields were sprayed with sodium arsenite at various strengths, and it was found that this poison with a 75 per cent. arsenious acid content used at the strength of 1 lb. to 16 gallons of water and 3 lb. of treacle killed about 70 per cent. of the insects, whilst an 80 per cent. arsenious acid content killed 75–80 per cent. The evidence also showed that the stronger arsenite might be used on the younger grasshoppers at the rate of 1 lb. to 20 gallons of water. It is also suggested that 4 lb. of treacle instead of 3 lb. would spread better and be more adhesive as well as more attractive to the insects. For young insects the spray should be applied to strips of grass about 30 feet wide, but for older insects these should be as much as 50 feet; it should be applied directly on to the insects as well as on the surrounding grass. The scorching of the grass as a result of the spray is superficial and quite temporary. Sheep kept in enclosed areas where the grass had been thoroughly sprayed with the above mixture received some injury which occasionally proved fatal, but its use is considered practically harmless in the fields where the sprayed area is small in proportion to the whole. Starlings and the wood swallow (*Artamus superciliosus*) feed on these grasshoppers.

FROGGATT (W. W.). **A Vine-destroying Longicorn Beetle (*Monohammus* sp.).**—*Agric. Gaz. N.S.W., Sydney*, xxx, no. 2, 3rd February 1919, pp. 129-131, 1 plate.

An attack by a species of *Monochamus* (*Monohammus*) on grape-vines is recorded but is considered possibly a casual one, the grape-vine not being a suitable food-plant for the larvae of so large a species of Longicorn. On the vines examined the eggs were found on the outer surface of the bark on the main stem about 4 or 5 inches above ground, the larva sometimes feeding under the bark up one side of the stem, but more frequently boring straight up the centre. Pupation takes place in any part of the stem, just under the bark in the end of a burrow. The life-cycle probably takes a year. The larva and pupa are described. The beetle is closely allied to the passion-vine borer [*M. fistulator*] and may be only a variety of that species.

HOLLINGER (A. H.) & PARKS (H. B.). *Euclemensia bassettella* **(Clemens), the *Kermes* Parasite (Micro-lepidoptera, Tineoidea, Oecophoridae).**—*Entom. News, Philadelphia, Pa.*, xxx, no. 4, April 1919, pp. 91-100, 1 plate.

The conclusion is arrived at both from the authors' own investigations and those of others that the moth *Euclemensia bassettella* is a parasite of *Kermes* and not a gall-feeder. *Blastobasis coccivorella*, Chamb. (which has not since been recorded) and *Laetilia* (*Dakruma*) *coccidivora*, Comst., are the only previously known Lepidopterous larvae infesting these scale-insects. A number of records are given

from various localities, especially Missouri and Texas, of *E. bassettella* parasitising *Kermes pettiti*, Ehrh., and *K. galliformis*, Riley, infesting several species of *Quercus*. All the early stages of the parasite, which are described, are spent in the body of the host. The larva, before pupating, cuts a hole in the hard wall, which is then closed firmly with tough silken threads, and through this the adult ultimately emerges. Descriptions of the adult and larva are given. *E. bassettella* appears to have only one annual generation, and is undoubtedly more widely distributed than its records show ; in a few cases it has been abundant enough materially to reduce the numbers of the Coccid.

FERRIS (G. F.). **Two Species of *Phylloxera* from California (Hemiptera; Aphidae).**—*Entom. News, Philadelphia, Pa.*, xxx, no. 4, April 1919, pp. 103–105, 2 figs.

Only two species of *Phylloxera* have hitherto been recorded from California, *P. popularia*, Perg., on poplars, and *P. salicola*, Perg., on willow. To these are now added *Phylloxera stanfordiana*, sp. n., on oak (*Quercus douglasi*). Some notes are also given on a species doubtfully identified with *P. salicola*, Perg., found exposed on the bark of *Populus trichocarpa* and *Salix* sp. in California and on *Populus candicans* in Utah.

MUIR (F.). **The Use of Insecticides against Leafhoppers.**—*Hawaiian Planters Record Honolulu*, xx, no. 3, March 1919, pp. 171–172.

As natural enemies destroy 90 per cent. of sugar-cane leaf-hoppers [*Perkinsiella saccharicida*], it has been suggested that the remaining 10 per cent. should be eradicated by means of insecticides. The author considers this a mistake until every possible use has been made of natural enemies. Insecticides would not only destroy the leaf-hoppers, but also greatly reduce the number of parasites, thus allowing the surviving leaf-hoppers every chance of increase.

LEWIS (A. C.), CHASE (W. W.) & TURNER (W. F.). **Spray Calendar.**—*Georgia State Bd. Entom., Atlanta*, Bull. 53, March 1919, pp. 5–39, 2 plates, 1 fig.

This bulletin contains the usual information concerning plant pests and the best methods for their control, with a diagram showing which sprays can be effectively mixed [see this *Review*, Ser. A, vi, p. 465]. Special tables are given for spraying apples, peaches, and pecan nuts and for dusting peaches in Georgia.

FELT (E. P.). **New Philippine Gall Midges, with a Key to the Itonididae.**—*Philippine Jl. Science, Manila*, xiii, Sec. D, no. 6, November 1918, pp. 281–325, 1 plate. [Received 23rd April 1919.]

Descriptions are given of fourteen new species of gall-midges with a key to the sub-families, tribes and genera of the ITONIDIDAE.

Snyder (T. E.). Injury to Casuarina Trees in Southern Florida by the Mangrove Borer.—*Jl. Agric. Research, Washington, D.C.*, xvi, no. 6, 10th February 1919, pp. 155–164, 4 plates, 2 figs.

As a result of reported serious injury to Australian pine (*Casuarina equisetifolia*) in Florida by the Buprestid, *Chrysobothris tranquebarica*, Gmel., investigations were made leading to the discovery that this beetle is a common enemy of the red mangrove (*Rhizophora mangle*), on which it has been known since 1886. All stages of the insect are described; the adults feed on the tender bark of the trees; the eggs are inserted under the thin outer layer of loose bark either singly or two or three together, each female being responsible for about 23. The period of incubation was not ascertained, but is probably one week. The emerging larvae bore through the cambium, on which they feed, to the surface, extending the burrows horizontally, spirally or longitudinally. The larval stage lasts nearly one year, at the end of which the pupal cell is excavated at a considerable depth in the wood with a hole for the exit of the adult beetle. The beetles begin to emerge about 1st April, the period of maximum activity being from April to 1st of June. Eggs are probably laid from middle of April to June, and the majority of pupal cells are formed before the winter.

Predaceous enemies are the flicker (*Colaptes auratus*) and the red-headed woodpecker (*Melanerpes erythrocephalus*). The larvae of a Trogositid beetle, *Tenebroides* sp., and of an Elaterid, *Adelocera* sp., were found under the bark of mangroves and may prey on this pest. Hymenopterous parasites are *Atanycolus rugosiventris*, Ashm., and *A. labena*, Rohw.

As remedial measures, all badly damaged trees should be cut and burnt between September and March; *Casuarina* trees between 1½ and 6 inches in diameter, growing in the vicinity of mangrove swamps or other infested trees, should be examined in September and March and if infested should be sprayed with ¼ lb. sodium arsenate dissolved in 5 U.S. gallons of water to which 1 pint of standard miscible oil has been added. This mixture may also be used to kill the adult beetles flying in April and August. As the presence of sap attracts the beetles, it is advisable not to prune the trees during these months.

Urbahns (T. D.). Life-history Observations on four recently described Parasites of *Bruchophagus funebris*.—*Jl. Agric. Research, Washington, D.C.*, xvi, no. 6, 10th February 1919, pp. 165–174, 2 plates, 8 figs.

The Chalcidoid, *Liodontomerus perplexus*, Gahan, of which the pupa and larva are described, feeds externally on the larva of *B. funebris* and only in exceptional cases is found attacking the pupa. Hibernation of the parasitic larvae takes place in the lucerne seed infested by the host. The parasite becomes active in April, slowly increasing to full activity in August. The eggs are inserted through the seed-pod and deposited on or near the host larva inside the green seed. The larvae develop very quickly, requiring only about 8–12 days to mature, when they may pupate at once; though should the seed be exposed to dry climatic conditions a dormant stage is entered upon which may last right into hibernation, thus delaying pupation until the following

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spring. The longest pupal stage observed in the laboratory under natural temperatures was 45 days, the shortest 8 days. The adult escapes by gnawing its way through the seed-pod. Under favourable conditions about 30 days are required for the complete development of each generation, of which in California there are probably three in one season. *Liodontomerus secundus*, Gah., another parasite of the larvae of *B. funebris*, has been previously described [see this *Review*, Ser. A, v, p. 405]. The parasitic larvae hibernate within the seed destroyed by their host. The pupal stage lasts 24–40 days in April, May and June, and the adults emerge in the spring, some having been noticed as late as July. There are probably two or more generations in a season.

The Pteromalid, *Eutelus bruchophagi*, Gah., hibernates in the larval stage. In the spring pupation is short, and the adults escape by gnawing through the seed wall, their life lasting one or two months. There are probably at least two generations in one season.

The larva and pupa of another Pteromalid, *Trimeromicrus maculatus*, Gah., are described, this parasite hibernating as early as September in the larval stage within the lucerne seed. Pupation takes place in the spring, the adults emerging from the seeds by the time the new pods are forming. The larva attaches itself to that of its host, which dies in the course of a few days, the parasite growing rapidly while feeding on the dead host. The longest pupal period observed was 15 days and the shortest 6 days.

FROST (S. W.). **Two Species of *Pegomyia* mining the Leaves of Dock.**—*Jl. Agric. Research, Washington, D.C.*, xvi, no. 9, 3rd March 1919, pp. 229–244, 3 plates, 1 fig.

Pegomyia calyptrata, Zett., is a common leaf-mining Anthomyid in America, but is very rare in Europe. It is believed that this fly feeds solely on *Rumex* spp., as attempts to rear the larvae on any other food-plant all failed. The eggs are laid in nature in groups of 3–5 or more on the under-surface of the leaf. The incubation period varies from 2 to 6 days, the young larvae immediately entering the leaf. The larval stage depends greatly on weather conditions, but averages from 9 to 15 days. On reaching maturity the larvae fall to the ground and penetrate the soil to a depth of 2 or 3 inches, where they pupate; if the soil is too hard, pupation takes place under fallen leaves or rubbish. The duration of the adult life is uncertain, as also is the number of generations in the year. From the puparia of *P. calyptrata* the parasites, *Opius quebecensis*, Prov., and *Dacnusa scaptomyzae*, Gah., were reared, and the eggs were found parasitised by *Trichogramma minutum*, Riley. An adult and nymph of the bug, *Nabis ferus*, L., were seen attacking the larva.

Pegomyia affinis, Stein, is much less common than *P. calyptrata*. The eggs are laid in the same way, but are less abundant. The incubation period is 3–7 days, and the larval stage varies from 12 to 18 days. This species also feeds exclusively on *Rumex* spp. There are probably only two generations a year, pupation taking place as in *P. calyptrata*. The early stages are described, and a comparative table of the characters of the two species is given.

BRANN (F. R.). **Spray versus Fumigation in the Control of Gray Scale on Citrus Trees in Tulare County.** — *Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 3, March 1919, pp. 104–107, 1 fig.

As a result of various experiments the author advises fumigation (especially with liquid hydrocyanic acid) in preference to spraying, as a remedial measure against *Coccus citricola*, Camp. (grey scale) on *Citrus*. Arsenate sprays not only exterminate the Coccinellid enemies of the scale, but also cause the leaves to drop.

PHILLIPS (E. F.). **The Control of European Foulbrood.**—*U.S. Dept. Agric. Washington, D.C.*, Farmers' Bull. no. 975, 16 p., 1 fig.

Less drastic methods are required for dealing with European than with American foulbrood in bees. In this bulletin the symptoms of the disease are described and special paragraphs are devoted to the basis of treatment, preventive and remedial measures.

THEOBALD (F. V.). **Apple Aphides.**—*Jl. Bd. Agric., London*, xxvi, no. 1, April 1919, pp. 63–71.

Of the eight Aphids known to attack apples in Great Britain, the three dealt with in this apper are: *Aphis malifoliae*, Fitch (blue or rosy apple aphis), *Aphis pomi*, De G. (green apple aphis) and *Siphonaphis padi*, *L.* (*Siphocoryne avenae* F.) (oat apple aphis). All three the spend winter in the egg-stage on apples or pears, and these hatch about April; *Aphis pomi* has been known to hibernate on thistles (*Carduus*).

The young of *A. malifoliae* live in the tops of bursting buds, and as they mature the leaves may curl up and protect them and their progeny. As their numbers increase, they pass to the shoots, stopping the growth and causing deformity of the internodes. These apterous females give rise to a winged generation about June and July; most of these die but some migrate, though to what plant has not yet been ascertained. In America it is believed they fly to plantains. Alate females return to the apple in September to November and produce the apterous egg-laying females and some alate males. This Aphid has been known to ruin the crop completely and cause a serious set back to the trees for the next season or even longer.

Aphis pomi is found densely packed beneath the leaves or in scattered groups, but the leaves are never curled to the same extent as by *A. malifoliae*. About June and July this Aphid multiplies very rapidly, the winged individuals, which are found from June to August, migrating to other apple and pear trees. The sexual forms appear in October.

The young of *S. padi* are found on the first leaves, alate females appearing about mid-June and migrating to cereals, especially oats, but sometimes also barley, wheat and grasses. In October winged females return to the apple and pear and produce the ovipositing individuals, eggs being laid on the trees as late as November.

Autumnal spraying to kill the egg-laying insects seems to be the most effective means of eradication; the spray should be applied heavily, more as a wash, and if possible after rain; if dusting is resorted

to, it should be applied in dry weather. A very satisfactory wash for *A. malifoliae* is : 1 to 1½ cwt. of lime slowly slaked and run through coarse sacking into 100 gals. water in which 5 lb. of salt have been dissolved. For killing Aphids in the spring the greatest success has been obtained with a heavy spray consisting of 10 lb. of soft soap to 100 gal. of soft water ; if the leaves are well open 8 oz. of nicotine should be added to every 100 gals. of wash, or in place of this 40 oz. of Pyridine may be used. Ants play a great part in spreading *A. malifoliae* over a plantation. Natural enemies of these Aphids are not of very much use as a means of control ; they include parasitic Chalcids and predaceous insects such as Coccinellid, Chrysopid, Syrphid and Cecidomyid larvae. The latter are most abundant in North Britain. Many fungous diseases also attack these Aphids.

PICARD (F.). **Sur un Ichneumonide** (*Sycophrurus hesperophanis*, **n. g. et sp.**) **Parasite de l'***Hesperophanes griseus* **F. dans les Branches de Figuier.**—*Bull. Soc. Entom. France, Paris,* 1919, no. 3, 12th February 1919, pp. 77–80.

Sycophrurus hesperophanis, gen. et sp. n., is described. This Ichneumonid emerges at Montpellier in June, occasionally in May, from branches of fig-trees attacked by *Hesperophanes griseus.* This Longicorn beetle is also parasitised by a Braconid, *Iphiaulax flavator*, F., and by *Xylonomus propinquus*, Tsch., which had previously been recorded only from Austria, but is now known to be common in Hérault.

BAERLIOZ (J.). **Description d'une Espèce nouvelle d'Eumolpide (Col. Chrysomel.) nuisible aux Cacaoyers de l'Ile San Thomé.** [Description of a new Species of Eumolpid injurious to Cacao-trees in the Isle of San Thomé.]—*Bull. Soc. Entom. France, Paris,* 1919, no. 4, 26th February 1919, pp. 88–89.

Lymidus variicolor, sp. n., is described from San Thomé in the Gulf of Guinea, where it feeds on the foliage of cacao-trees, the cultivation of which is one of the principal industries in the Island. The economic importance of this beetle has not been investigated ; allied species, such as *Syagrus costatipennis*, Jac., have been reported on cacao from Nossi-Bé (Madagascar).

Reports on the State of the Crops in each Province of Spain on the 20th March 1919.—*Bol. Agric. Técnica y Económica, Madrid,* xi, no. 123, March 1919, pp. 260–276.

As a result of the winter campaign against locusts, it is reported that in the province of Madrid, out of some 7¼ square miles invaded, approximately 5⅓ have been cleared.

BEZZI (M.). **Una nuova Specie brasiliana del Genere** *Anastrepha* **(Dipt.).** [A new Brazilian Species of *Anastrepha.*]—Separate, dated 20th March 1919, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici,* xiii, 14 pp., 1 fig.

A new Brazilian fruit-fly, *Anastrepha bistrigata*, is described and a key is given to this and the following species, which are briefly discussed : *A. daciformis*, Bezzi, *A. grandis*, Macq., *A. serpentina*, Wied.,

A. soluta, Bezzi, *A. obliqua*, Macq., *A. fraterculus*, Wied., *A. pseudoparallela*, Lw., *A. distans*, Hend., and *A. suspensa*, Lw. The remaining Brazilian species are: *A. integra*, Lw., *A. parallela*, Wied., *A. consobrina*, Lw., *A. ethalea*, Wlk., *A. xanthochaeta*, Hend., *A. hamata*, Lw., and *A. bivittata*, Macq. Thus there occur in Brazil 17 species of this genus, which in the tropical regions of America plays the same rôle as *Dacus* in the Old World.

WILLIAMS (C. B.). **The Food of the Mongoose in Trinidad.**—*Bull. Dept. Agric. Trinidad & Tobago, Trinidad*, xvii, no. 4, 1918, pp. 167–186. [Received 28th April 1919.]

In the course of investigations that have been carried on in Trinidad during recent years upon the control of *Tomaspis saccharina* (sugar-cane froghopper), the question of the influence of the mongoose on the abundance of this insect has frequently been raised, it being held by some that the advent of the series of froghopper plagues has closely followed the spread of the mongoose.

Examination of the stomach contents of the mongoose carried out from October 1917 to September 1918 led to the conclusion that the destruction of lizards, frogs and toads is only partly offset by the numbers of injurious insects destroyed, and there is little doubt that the presence of the mongoose in large numbers in a district will in this way have an unwelcome effect on the numbers of insects present. The chief insects taken as food in order of abundance were:—Grasshoppers, cockroaches, miscellaneous beetles, Carabid larvae, Lamellicorn adults and larvae, fly larvae and adult and larval weevils.

DUPORT (M.). **Rapport sur le Fonctionnement de la Station entomologique de Cho-ganh (Juin à Octobre 1918.)** [Report of the Entomological Station of Cho-ganh (June to October 1918).]—*Supplement to Bull. no. 119, Chambre Agric. Tonkin et Nord-Annam, Hanoï*, 1918, 7 pp. [Received 29th April 1919.]

The continuation of the investigations on *Xylotrechus quadripes*, Chevr. (coffee borer) begun in 1914 is recorded [see this *Review*, Ser. A, vii, p. 50–54.] There are still many points to be elucidated in the life-history of this Longicorn beetle. The length of the life-cycle has not been determined; eggs are laid on the stems more or less actively throughout the year, and the author is convinced that the duration of the life-cycle varies according the date of oviposition. Other points as yet undetermined are the natural enemies of the species, the plants other than coffee on which it lives, its geographical distribution, the relative importance of the damage caused by it in various countries of the Far East, the factors which render it unequally injurious in the various regions in which it occurs, etc. The principal experiments carried out are recorded. The life-cycles at various seasons are being determined by placing fresh coffee-plants each month in a cage with adults. Many attempts have been made to discover the various plants and dead wood attractive to the borer. In addition to those mentioned in the previous report, many native plants were tried, but most of them, including bamboo, do not seem suitable for oviposition by *X. quadripes*. Teak, however, appeared to be as

attractive as coffee, females ovipositing freely even on trunks 6 to 8 ins. in diameter. Larvae hatching from eggs deposited on teak between 20th and 25th September developed normally and constructed large galleries. It was not thought probable that *X. quadripes* could breed in dead wood, but it has been found to breed normally in very dry wood of coffee, both of *C. arabica* and *C. liberica*, and in both fresh and dry stems of teak and *Gardenia*. Smooth, glossy stems such as those of bamboo seem unattractive to the females. No insects other than *Xylotrechus* have been taken on *C. arabica*. Certain ants and spiders prey upon adults of the borer.

Experiments with various substances to coat the stems have been continued; the difficulty is to find an elastic substance that is not too costly for practical use. Besides the development of the stems rendering an elastic substance necessary, the action of rain, wind, sun and ants are all factors to be reckoned with. Tar and coal-tar are efficient, but cannot be used without injury to the tree. At Cho-ganh, when the coffee plants begin to dry off, from June to September, the stems contain only larvae and a few pupae. There may be a few adults present, but these are in a very small proportion, considerably less than 1 per cent. From stems cut and placed under observation adults began to emerge about one month after their removal. Experiments are being continued with various toxic substances applied to the roots of coffee plants, but the results with these have as yet been negative. The plants treated dry up or lose their foliage, while the larvae continue to develop.

In India, where *X. quadripes* has caused very little damage during the last 50 years, it has again become a most serious pest of coffee. In the districts of Coorg and Mysore great loss has occurred, the native plants, *Olea divica* and *Wendlandia* sp., serving as food-plants of the borer.

The pests attacking rice at Tonkin are also being made the subject of an investigation.

GUITEL (F.). **La Station entomologique de la Faculté des Sciences de Rennes en 1917.**—*Insecta, Rennes*, viii, no. 85-96, 1918, pp. 177-181. [Received 29th April 1919.]

The establishment of war-time vegetable gardens has led to many enquiries concerning the commoner vegetable pests. Among the less known, the Microlepidopteron, *Acrolepia assectella*, is a serious pest of leeks in many widely-scattered localities in France, the larvae mining in the plants. The best remedy is to cut the leeks before the damage has been done. The beetle, *Cassida inquinata*, is local and not very abundant, but has done important damage to chamomile (*Anthemis nobilis*) in the Maine-et-Loire district.

DUFRENOY (J.). **Les Formes de Dégénérescence des Chenilles de *Cnethocampa pityocampa* parasitées.** [The Forms of Degeneration of parasitised Larvae of *Cnethocampa pityocampa*.]—*C.R. Soc. Biol. Paris*, lxxxii, no. 9, 29th March 1919, pp. 288-289.

The various bacilli that are liable to infect larvae of *Cnethocampa pityocampa* and the manner of their attack are described. These include *Bacterium pityocampae*, *Streptococcus pityocampae* and a

fungus apparently of the genus *Beauveria*. While bacterial affections produce a general liquefaction of the body cells, mycosis produces a mummification that preserves in a remarkable degree the morphology of the organs.

SHINSUKE ITO (G.). **El Arroz.** [Rice.]—*Bol. Minist. Agric., Buenos Aires*, xxiii, no. 1, January-December 1918, pp. 3-123, 47 figs. [Received 30th April 1919.]

Locusts are not as a rule injurious to rice cultivation in Argentina, their invasions generally occurring either at the time of sowing or of gathering the crop. Occasionally, however, an invasion occurs during the period of growth; in this case, the rice-fields are flooded in order to check the attack A bug, *Nepa cinerea*, is said to cut through the base of the young rice-plant. The measures adopted against this pest is the drying of the rice-fields. *Gryllotalpa gryllotalpa* (*vulgaris*) constructs galleries about the rice-fields; *Thrips oryzae* and *T. oryzophaga* in their larval stages cause more or less serious damage to the plants.

Stored rice is liable to attack by a moth and a weevil [*Calandra oryzae* ?]. The best preventives of such attack are cleanliness, thorough ventilation of the storehouses and the isolation of infested rice. Before use, the storehouse should be thoroughly disinfected with a 20 per cent. "acaroina" solution or a 5 per cent. to 10 per cent. formalin solution; this treatment should be given twice with a few days' interval. Before storage, the grain should be fumigated with carbon bisulphide at the rate of about 5¼ oz. per 35 cub. ft., the process lasting from 24 to 48 hours. Bags should not be piled one above the other but should be placed separately for thorough ventilation.

MUELLO (A. C.). **Instrucciones prácticas sobre el Cultivo del Algodonero.** [Practical Instructions on the Growing of Cotton.]—*Bol. Minist. Agric., Buenos Aires*, xxiii, no. 1, January-December 1918, pp. 148-155. [Received 30th April 1919.]

In the cotton-growing district of Argentina known as the Chaco, besides the usual depredations of locusts and ants, the cotton fields are infested every year by *Alabama* (*Aletia*) *argillacea*. This moth pupates in the curled leaves, this stage lasting from a week to a month, and there may be as many as seven generations in a season. The caterpillars generally appear when the plants begin to flower and form squares, but occasionally they infest and destroy quite young plants. They mainly occur in February and March, continuing sometimes as late as October. Warm, humid weather encourages the development of this pest. The only measure against the adults is the use of light-traps. For the larvae, white arsenic or Paris green are used, generally the latter, either in the proportion of 2 to 5 lb. in 100 gals. water, with a little carpenters' glue or molasses to act as an adhesive, or in powder form, using 1 to 2 lb. per acre, applied while the dew is on the plants. Another pest is an unidentified caterpillar that cuts through the young plants at the root. Cabbage leaves are suggested as a trap for these.

RIVEROS (E.). **Citrus cultivados en el Chaco.** [Citrus Culture in the Chaco Region.]—*Bol. Minist. Agric., Buenos Aires,* xxiii, no. 1, January-December 1918, pp. 156–160. [Received 30th April 1919.]

The cultivation of citrus in the Chaco district is not affected by many insect pests. Two species of scale-insects occur throughout the citrus plantations, the commonest being *Lepidosaphes beckii* (*Mytilaspis citricola*); these, however, do not cause serious damage and measures against them are very seldom adopted, though it is possible that they may develop into a serious menace to the industry.

SAALAS (U.). **Die Fichtenkäfer Finnlands. Studien über die Entwicklungsstadien, Lebensweise und geographische Verbreitung der an *Picea excelsa*, Link., lebenden Coleopteren nebst einer Larvenbestimmungstabelle.** [The Spruce Beetles of Finland. Studies on the Developmental Stages, Life-History and Distribution of the Coleoptera living on *Picea excelsa*, Link., with a Key to the Larvae.]—*Annales Academiae Scientiarum Fennicae, Helsingfors*, Ser. A, viii, no. 1, 1917, 547 pp., 9 plates, 1 map.

The Coleopterous fauna of Finland has been relatively well worked from a systematic point of view, though biological data are almost entirely lacking. In this volume, which is the outcome of investigations carried on from 1912 to 1915, the term "spruce beetle" is used in a wide sense, and includes such species as only occasionally occur on *Picea excelsa*. On the other hand those beetles are excluded that are not truly arboreal, but shelter beneath the spruce bark more or less by chance. For instance, *Pyrochroa pectinicornis*, a typical birch insect, has been included because the larvae that were examined had apparently spent the entire larval stage under the spruce bark, whereas certain Chrysomelid, Curculionid and other beetles that are found under the bark, especially in autumn and spring, have been omitted because their true habitat is elsewhere. The exceptions to this last rule are justified in the second part of this volume, in which, under an arrangement according to families, the species are dealt with singly, many details of the life-history, distribution and habitat being recorded in each case.

The first part, covering 276 pages, deals generally with these beetles, their economic importance, distribution, food and occurrence on various parts of the spruce, and contains many tables. In a number of cases the existing literature does not afford adequate means for identification and in many of them the adult had to be bred out. The key at the end of this work is intended to enable the larvae of all the species known to the author to be identified. Of those that he is unacquainted with only a few are included owing to the difficulty in finding satisfactory characters for comparison. The number of species fully dealt is 341 of which 289 were actually observed to occur in more or less abundance on spruce. This last figure represents 9·9 per cent. of the 2,927 species of Coleoptera recorded in Finland up to 1900 according to the "Catalogus Coleopterorum Faunae Fennicae" of J. Sahlberg, the author's father.

HARUKAWA (T.). **Momo-Habachi ni tsuite.** [On the Peach Sawfly.] —*Byochugai-Zasshi* [*Journal of Plant Protection*], *Tokyo*, vi, no. 1, 5th January 1919, pp. 51–59, 1 plate.

A new sawfly, *Eriocampoides matsumotonis*, is described. It is closely allied to *E. limacina*, Retz., of Europe and America, from which it may be distinguished by the sooty tint of the wings. Its broods appear to be very irregular, but from breeding experiments three generations per annum appear to be the usual number. Winter is passed in the larval state within cells in the ground, and it is noteworthy that, as in *E. limacina*, some mature larvae of the second brood hibernate in that stage. The egg is laid singly beneath the epidermis of the upper surface of the leaf, oviposition being effected by the female insect from the under-side. The blisters thus caused are transparent in the case of the peach and of a brownish colour in the cherry. The number of eggs laid by a single female is 22 or 23 on an average, and parthenogenesis may occur. The peach, pear, cherry (both the flowering and fruiting varieties) and plum are attacked, especially the first two. An Ichneumonid parasite of the larva was discovered in 1918. As preventive measures emulsions of soap or kerosene are efficacious, as well as collection of the pupae in winter. Lead arsenate is also recommended.

Sangyo Torishimari Seiseki. [Results of Silk Industry Control in 1917.] —*Agricultural Bureau, Department of Agriculture and Commerce, Tokyo*, 25th March 1919, 226 pp., 2 maps, 1 table.

This is a statistical summary of results from reports from the prefectural Governments during 1917, relating to the application of regulations respecting the silk industry. It describes the results of measures for the prevention of disease in silkworms and for the cold-storage of broods.

Gaichu ni kwansuru Chosa. [Researches on Injurious Insects.]—*Kwangyo Mohanjo Kenkyu Hokoku* [*Bulletin of Industry Model Station*], *Suwon, Korea*, March 31st 1919, 82 pp., 13 plates.

In this report, the life-histories of, and preventive measures for dealing with the following insects are described. The Chrysomelid beetle, *Donacia aeraria*, Baly, has one annual generation and hibernates in the larval stage in the earth, where it attacks the roots of rice. The eggs require to be in water and die if exposed to the air. They are usually laid on the under-side of the floating leaf of *Potamogeton polygonifolius* at the end of July, so that removal of this plant proves to be an effective preventive measure. A weevil, *Echinocnemus bipunctatus*, Roel., also has one annual generation; it hibernates in the larval stage under ground the adults appearing in July. It attacks the roots of rice in considerable numbers. The Noctuid, *Cirphis unipuncta*, Haw., passes the winter in the pupal stage, the adults of the first generation appearing in June and those of the second in July. It attacks rice, Bengal grass, oats, wheat, *Panicum frumentaceum* and sorghum. *Serica* sp. occurs once a year, the adult beetles occurring from April to June. It hibernates in the larval stage or occasionally as an imago. It attacks barley, tobacco, cotton, hemp, soja bean, cabbage, peach and mulberry.

The sawfly, *Athalia colibri*, Christ., appears twice a year, first in May and secondly in July; it hibernates in the larval stage and attacks raddish, turnip, etc. *Eriosoma lanigerum*, Haw. (woolly aphis) may have as many as 10 annual generations. The sawfly, *Hylotoma mali*, Mots., has three annual generations, hibernating in the larval stage, and is a serious pest of apple foliage. The moth, *Phyllorycter* (*Lithocolletis*) *malivorella*, Mots., has six generations and hibernates in the adult or pupal stage under fallen leaves. It chiefly attacks young apple foliage. Another undetermined Microlepidopteron is injurious to apple leaves. The Lamellicorn beetle, *Lachnosterna diomphalia*, Butl., appears in July and August, and hibernates in the larval stage; it feeds on roots of both living and decaying plants. *Metzeneria* sp. appears once a year and hibernates in pupal stage. This moth produces galls on pear branches. An undetermined Chrysomelid beetle also infests pear leaves. The Limacodid moth, *Parasa sinica*, Moore, appears twice a year and hibernates in the larval stage; it attacks the foliage of pear, apple, peach, plum, cherry, apricot, etc. An undetermined Aphid infests peach, plum, apricot, etc. The weevil, *Byctiscus lacunipennis*, Jekel, hibernates as an adult which becomes active in May and attacks young vine leaves. The moth, *Dendrolimus remota*, Wlk., which passes the winter in the larval state, attacks pine. The sawfly, *Diprion basalis*, Mots., passes the winter in the egg stage, the larva appearing at the end of April and attacking pine. *Porthetria* (*Lymantria*) *dispar*, L. (gipsy moth) winters in the egg stage, the caterpillars appearing at the end of April and attacking black alder, apple, *Quercus serrata*, etc. A species of *Nematus* winters in the larval state within the cocoon and attacks black alder. The Chrysomelid beetle, *Plagiodera distincta*, Baly, which attacks willow, has two annual generations and winters in the adult stage. *Drymonia* (?) *manleyi coreana*, Nag., passes the winter as an egg, and the larva attacks *Quercus serrata*. All the above insects are described and figured in detail.

In the second part of this report the life-history of *Chilo simplex*, Butl., is described. The moths of the first brood appear in large numbers at the beginning of May, and those of the second brood in August. The first brood adults do not lay eggs on the apex of the rice leaf, as is the case in Japan, and oviposition mostly occurs in the leaf-sheath or on the under-side of the leaf. Unlike the Japanese race, Korean individuals chiefly hibernate in the rice stubble, so that the burning of it is an effective measure. Leaf-hoppers and locusts are also abundant and do some damage to rice.

Other pests recorded include a Nematode infesting wheat, *Phylloxera* on vines, and an undetermined Buprestid boring in apple trees.

KAWAMORITA (R.). **Fusan-Sanga no Yobo ni tsuite.** [The Prevention of Infertility in Silkworms.]—*Sangyo-Shimpo* [*Journal of the Silk Industry*], *Tokyo*, Year xxvii, no. 313, 1st April 1919, pp. 221–224.

Infertile individuals among silkworms are usually more common in the introduced European race and its hybrids. This may be prevented by feeding with mature foliage only and ensuring that the mulberry plantations are fully exposed to air and sunshine, and not too heavily manured.

HATA (S.). **Sanji no Shiryo to shiteno Shaku to Kenshitsu tono Kankei.** [On the Relation of the Quality of Silk to the Feeding of Silkworms on *Cudrania triloba*].—*Sangyo-Shimpo* [*Journal of the Silk Industry*], *Tokyo*, Year xxvii, no. 313, 1st April 1919, pp. 316–320.

It is a well known fact that silkworms fed on *Cudrania triloba* produce a more elastic silk than those reared on mulberry leaves. The *Cudrania* leaf contains more tannin (7·9 per cent.) than that of the mulberry (6·5 per cent.), and the author found that by the addition of the requisite quantity of tannin to the mulberry leaf, he was successful in obtaining increased elasticity in the silk. On the other hand *Cudrania* contains less lime (3·5 per cent.) than the mulberry (4·5 per cent.), and this is in opposition to the known fact that mulberry foliage containing more lime produces a more elastic silk. Further investigation on this point is therefore required.

MITSUHASHI (S.). **Nihonsan Kitteichu-rui ni tsuite.** [On the Japanese Buprestidae.]—*Byochugai Zasshi* [*Journal of Plant Protection*], *Tokyo*, vi, no. 4, 5th April 1919, pp. 272–277.

The author enumerates 69 species of BUPRESTIDAE known to occur in Japan, with particulars of their food-plants. Attention is called to the fact that *Buprestis japonensis*, Saund., according to Prof. Sasaki, has been recorded as injuring lead-piping. Other species of economic importance are: *Chrysochroa elegans*, Thunb., in *Quercus acuta* and *Pinus thunbergii*; *Chrysodema amabilis*, Voll., in *Pinus thunbergii*; *Chalcophora japonica*, Gory, in *Pinus* and *Quercus*; *Chrysobothris succedanea*, Saund., in broad-leaved trees; *Dicera aino*, Lewis, in *Abies sachalinensis*; *Agrilus spinipennis* in *Zelkowa acuminata* and *Ulmus parvifolia*; and *Trachys griseofasciata*, Saund., in *Z. acuminata*.

MILLER (D.). **Injurious Insects in New Zealand.**—*New Zealand Jl. Agric., Wellington*, xviii, no. 2, 20th February 1919, p. 101. [Received 5th May 1919.]

Of all the injurious insects in New Zealand only 18 per cent. are indigenous, the remaining 82 per cent. originating chiefly from Europe. Although the pests attacking field and vegetable crops constitute the smallest group, the greatest losses occur amongst these crops. This is probably due to the absence of legislation and the scarcity of information regarding them.

RITCHIE (W.). **The Structure, Bionomics and Forest Importance of** *Cryphalus abietis*, **Ratz.**—*Ann. App. Biol., Cambridge*, v, nos. 3–4, April 1919, pp. 171–199, 15 figs.

Owing to the increasing number of records of *Cryphalus abietis*, Ratz., in Scotland, this Scolytid beetle can no longer be counted as a rare species in Britain. A description is given of all its stages. The period of the life-cycle from egg to adult varies under different conditions, the average being from 93 to 108 days. The eggs, which take about 10 days to hatch, are laid irregularly in batches along the brood gallery. The female does not necessarily complete the gallery before commencing oviposition; 5 to 7 weeks are required

to complete the gallery and each female lays about 14 to 24 eggs. The mother gallery usually takes the form of a circular burrow round the base of a branch or twig, and weak branches may be completely girdled. The larval galleries run almost at right angles to the mother gallery, the larvae boring alongside the mother gallery at first and separating later to gnaw the inner bark layers. The mother galleries never penetrate the sap-wood, and the larval galleries as a rule do not groove the sap-wood until the insects are just about to pupate. If the branch is very thick pupation may take place in the bark. The larvae feed for about 69 days before pupation, the pupal stage lasting about 22 to 29 days. The young beetles feed on the bark surrounding their pupal bed, gradually boring through it to effect an exit. The length of the adult stage and number of generations in the year has not been definitely ascertained. It is probable that after oviposition the female enters another period of feeding and a second pairing and egg-laying take place. Sometimes the females die after oviposition.

In Scotland *C. abietis* usually breeds in the stems, branches and twigs of unhealthy, dying or dead trees of *Abies*, *Picea* and *Pseudotsuga*. Trees of the genus *Abies*, especially *A. pectinata*, seem to be preferred, the others only being normally attacked in their absence. On the continent of Europe *C. abietis* seems to prefer *Picea* spp., although it is known to attack other genera of conifers. So far this beetle has not proved destructive to living trees. Attention is called to the fact that the adult beetles, being negatively heliotropic, prefer for brood purposes twigs of branches in shady places. The natural enemies of the larvae include a Chalcid that has been known to destroy 75 per cent. of them. Only one parasitic larva is found on each host.

Green (E. E.). **A list of Coccidae affecting various Genera of Plants.**—*Ann. App. Biol., Cambridge*, v, nos. 3 and 4, April 1919, pp. 261–273.

This paper forms the concluding part of the author's list of Coccids and their food-plants [see this *Review*, Ser. A, vii, p. 70, etc.].

It is noted that the Gramineae, including the bamboos, have a special Coccid fauna comprising such genera as *Antonina, Aclerda, Eriopeltis, Lecanopsis* and *Odonaspis*. The Coniferae have a monopoly of the genus *Physokermes,* while *Kermes* is confined to species of *Quercus*.

Among those Coccids that have the largest number of food-plants are *Pseudococcus citri*, *Coccus* (*Lecanium*) *hesperidum*, *Lepidosaphes ulmi* and *Aspidiotus hederae*.

Chittenden (F. H.). **The Sweet Potato Weevil and its Control.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1020, January 1919, 24 pp., 13 figs. [Received 6th May 1919.]

Cylas formicarius, F., is becoming very destructive and threatens to invade all States where sweet potatoes are grown. The importance of this crop may be gauged from the fact that the value of that for 1918 was estimated at over £23,000,000, while the loss in several States has amounted to from 10 to 20 per cent. The life-history and the usual measures against this weevil are discussed [see this *Review*, Ser. A, vii, p. 21, etc.].

Though it has a wide distribution in the tropics, evidence points to Cuba as the source of introduction into the United States and that this originally occurred prior to 1875. Some localities erroneously attributed to this species refer to *C. turcipennis*, Boh., from India, Java and Borneo, which has similar habits, and another related species *C. femoralis*, Faust, infests sweet potatoes in Liberia.

DUDLEY (F. H.). **Four of the most injurious Corn Pests.**—*Bull. Maine Dept. Agric., Augusta*, xviii, no. 1, March 1919, pp. 27–30. [Received 7th May 1919.]

Important Lepidopterous pests of maize include :—*Pyrausta nubilalis* (European corn borer) which has become a serious problem in Massachusetts [see this *Review*, Ser. A, vii, p. 224]; *Heliothis obsoleta*, F. (corn ear-worm); *Papaipema nebris* (*nitela*) (corn-stalk borer), which feeds in the spring on grasses and weeds and later attacks maize and potatoes, usually about July; there is only one brood a year and the eggs are generally laid in the grass lands in the autumn and hatch the following spring; to control it all grass adjoining maize fields should be mown and immediately burnt; and *Estigmene acraea* (salt-marsh caterpillar), which by feeding on the silk of maize prevents pollination of the ears; other food-plants include various garden vegetables and weeds; hand-picking is recommended as a remedial measure.

SASSCER (E. R.). **Important Foreign Insect Pests collected on imported Nursery Stock in 1918.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 133–136.

The insects collected from nursery stock offered for entry into the United States during 1918 included :—*Pectinophora gossypiella*, Saund. (pink bollworm) on cotton from Brazil; *Acronycta rumicis*, L. (sorrel cutworm), in the pupal stage on miscellaneous plants from France; caterpillars of *Diurnea* (*Chimabacche*) *fagella*, F., on rhododendrons from Holland and reported to be injurious in Ireland to the foliage of oak, beech and birch; larvae of *Arctornis chrysorrhoea*, L. (*Porthesia similis*, Fuessl.) (gold-tail moth) on Japanese maple from Holland and on *Cerasus avium* from France; 194 nests of the butterfly, *Aporia crataegi*, L., on deciduous fruit-tree seedlings from France; *Gracilaria zachrysa*, Meyr. (azalea leaf-miner) on azaleas from Holland; *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, auctt.) (brown-tail moth) and *Porthetria dispar*, L. (gipsy moth) on miscellaneous plants from France; the Syrphid flies, *Eumerus strigatus*, Fall., and *Merodon equestris*, F., in narcissus bulbs from Holland, the former having been known to destroy a whole crop of onions; dead adults of *Anthonomus rectirostris*, L., in seeds of the wild cherry (*Cerasus avium*) from France; *Rhabdocnemis* (*Sphenophorus*) *obscura*, Boisd., in sugar-cane from the Hawaiian Islands; an undescribed species of *Conotrachelus* and an unrecognised *Stenoma* in avocado seeds from Guatemala.

The most important scale-insects intercepted were *Eulecanium* (*Lecanium*) *persicae* (European peach scale) on *Fontanesia* and *Berberis purpurea* from France and on peach from England; an undescribed

species of *Solenococcus* on avocado from Guatemala; *Parlatoria chinensis*, Marl., on two species of *Pyrus* from China; and *Eulecanium* (*Lecanium*) *coryli*, L., on an undetermined plant from England.

BALL (E. D.). **The Potato Leafhopper and its Relation to the Hopper-burn.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 149–155, 1 plate, 5 figs.

This is an amplification of a previous article [see this *Review*, Ser. A, vi, p. 489]. In the summer of 1918 scorching of potato foliage occurred in different parts of the Northern United States, receiving a different name in each locality. All injured leaves examined showed signs of the presence of *Empoasca mali*, Le B. (potato leaf-hopper). This fact combined with cage experiments has led to the conclusion that this insect is directly responsible for the scorched appearance on potato leaves as well as on dahlias, box elder, apple and raspberry. It is not yet proved whether the relation of the disease to the insect is specific or not. The appearance of the disease varies according to temperature and moisture. The burned margin increases until the leaf dies and eventually the whole plant succumbs. Rapid growing varieties of potato suffer the least. Probably the disease referred to in the past as "tipburn" was due to this leaf-hopper.

Empoasca mali produces two generations on potatoes; the adults appear when the early potatoes come up and lay their eggs on the stems and midribs of the leaves. The nymphs feed on the under-surface of the leaf and only migrate to other leaves when the first one is dead. In July and August the adults of the first generation either oviposit on the plants on which they themselves have been bred or migrate to late potatoes, on which they give rise to the second generation.

Affected plants should be sprayed every 8–10 days with strong kerosene emulsion or Black-Leaf 40; one pint to 100 U.S. gals. should be used, with the addition of 5 lb. of soap. The spray must be applied to the under-surface of the leaves and will kill both nymphs and adults.

BURGESS (A. F.). **Organisation for Insect Suppression.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 136–141.

Insect suppression falls into two classes; the control of widely distributed insects and the control of newly established pests in a limited area. It is suggested that closer relations should be established between the State and Federal Authorities to facilitate the efforts of the officials engaged in this work.

As regards the problem of introduced pests the Federal Government has recognised its responsibility, but the work of the entomologist has often to suffer from incompleteness owing to want of funds. The successful organisation of insect suppression involves good business management as well as entomological knowledge.

O'KANE (W. C.). **Limitations in Insect Suppression.**—*Jl. Econ. Entom. Concord, N.H.*, xii, no. 2, April 1919, pp. 155–162.

Some of the problems and difficulties arising when starting a campaign against new and serious insect outbreaks are discussed. One

of the chief difficulties is the lack of accurate knowledge concerning the pest under consideration. It is suggested that the work to be undertaken in the case of important pests should devolve upon the Federal Bureau of Entomology as well as the States immediately concerned. Should the Government undertake the task, the execution of it could be placed in the hands of trained men who would be in a position to carry out the work completely and at the proper time.

Where complete eradication is impossible and the pest can only be kept well in check, there is every reason why the property owner should undertake his share of the burden. If the support of farmers is to be obtained, a definite plan of education, with regard to insect control, will have to be adopted. Though posters and bulletins are of great value for this purpose, verbal explanations reinforced by circulars distributed at the same time are considered to be the most effectual means of educating the public.

Another important factor that has to be considered is the limitation of human capabilities, it being almost impossible to combine in one individual a perfect administrator and a successful scientific investigator.

GUYTON (T. L.). **Nicotine Sulphate Solution as a Control for the Chrysanthemum Gall Midge,** *Diarthronomyia hypogaea*, **H. Lw.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 162–165, 1 plate.

Cage and greenhouse tests were made with a view to controlling the emerging midges by means of 1 volume nicotine sulphate containing 40 per cent. nicotine to 500 volumes of water, with the addition of one ounce of fish-oil soap to every gallon of solution. A table is given showing the results; these were successful provided that the plant was completely covered with the solution and the spray repeated every 4 or 5 days as long as any living forms of the midge remained in the galls. This spray does no damage to the plant.

HUNTER (W. D.). **The Work in the United States against the Pink Bollworm.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 166–175.

The bulk of the information contained in this paper has been previously dealt with [see this *Review*, Ser. A, vi, p. 543]. Although *Pectinophora gossypiella*, Saund., has not been completely eradicated in the United States, it has been reduced very nearly to vanishing point. Owing to this fact and the present methods of control adopted, a fresh infestation recorded in Texas does not detract from the hopeful outlook.

HOLLOWAY (T. E.). **Parasite Introduction as a Means of saving Sugar.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 175–178.

Investigations for the control of *Diatraea saccharalis* (sugar-cane moth borer) have been carried on for many years in Louisiana, but the work was interrupted owing to the war and to lack of funds. In 1918 funds were raised by the planters, and the author proceeded to

Cuba to collect parasites, where he found four species. The egg-parasite, *Trichogramma minutum*, Riley, already occurs in Louisiana. The Tachinid fly, *Euzenilliopsis diatraeae*, Towns., usually emerges from the larvae, but sometimes also from the pupae of this moth. The puparia of this parasite were shipped in tin boxes containing damp sphagnum moss and cotton, and these were packed in card-board cases. About 33 per cent. arrived in New Orleans alive. They travelled better when ventilation holes were made in the boxes. In New Orleans the parasites passed through two, possibly three, generations. As they pass the winter in a dormant state the attempt to breed them all the year round in heated greenhouses was not successful. Should this Tachinid become established in Louisiana, it will prove a very valuable asset to the control of *D. saccharalis.*

The other two parasites found were the Hymenoptera, *Bassus* (*Microdus*) *stigmaterus*, Cress., and *Apanteles* sp., but as these were very rare, it was decided not to attempt to introduce them without further study.

FLINT (W. P.), TURNER (C. F.) & DAVIS (J. J.). **Methods in Entomological Field Experimentation.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 178-183, 1 plate.

Various methods are described that were tested in Illinois to obtain accurate records of infestation of wheat fields by Hessian fly [*Mayetiola destructor*]; these included the picking method, the method of selecting —at haphazard—five linear yards and examining all the plants in each yard, and the similar selection and examination of half a square yard. Tables show the results of the counts made by the different methods both in 1917 and 1918. These indicate that the above-ground appearance of plants should be used only in generalising infestation, such as heavy, medium or light. The picking method is useful in autumn scouting work, when estimating Hessian fly infestations, but is practically useless in the spring and also in the autumn, if the wheat-plants have tillered abundantly. For experimental plots where simplicity, accuracy and comparison of results are essential, the linear foot method is undoubtedly the most satisfactory, and at least ten linear feet should be taken from each plot where counts are required.

In the matter of estimating yields various methods have also been studied. It is the opinion of some agronomists that reliable records can be obtained only by harvesting the entire plots. Others hold that accurate yields can be obtained by harvesting such small areas as one-thousandth of an acre. It is hoped to obtain the use of a portable threshing outfit in order to make a comparison of the different methods. In the meantime, the method used to obtain the yields in wheat-sowing experiments in connection with Hessian fly is to select five typical square yards from each plot. The wheat from this area is bagged, transported to a central point and there threshed, weighed and graded, the grain being tested and its quality recorded. It is not claimed that this method is the best possible, and in point of fact it seems to give records above the actual yields, but it provides a fair method of comparison, which is the main consideration.

Estimates of injury by insects are frequently difficult to determine. Where large areas are completely destroyed by such insects as white

grubs [*Lachnosterna* spp.], army worms, grasshoppers or chinch bug [*Blissus leucopterus*], the estimation of damage is comparatively simple; but where injury is inconspicuous, as in the case of scale-insects, corn root aphis [*Aphis maidiradicis*], Hessian fly, chinch bug in wheat, and the joint worm [*Isosoma tritici*], it is far more difficult to calculate. In some cases, where the damage is restricted to a definite area, it is possible to obtain an accurate estimate of injury by comparing yields of that area with a similar uninfested area in previous years as well as the year of injury, consideration being given to the climatic conditions in the two areas. Where the injury is widespread, the only known method is to compare the yields during the season of injury with previous seasons' yields, taking into consideration the insect injuries of previous years and comparableness of climatic conditions and acreage. In the case of injury by Hessian fly and joint-worm, comparison can be made with previous years, but there is no basis to compute accurately the injury in individual fields, since there is no reliable comparison between infestation and injury. It is proposed to obtain positive data another year concerning these insects by enclosing large areas during their oviposition period, two to be kept free from infestation and two to be infested by introduction of the respective insects. It is hoped that others may make similar tests with other insects. In order to obtain reliable results it is essential to continue the experiments over a period of years. If, for example, recommendations for sowing wheat with regard to Hessian fly infestation had been based on the 1918 experiments only, they would have been inaccurate, since the fly-free date in 1918 was earlier than the normal. Continuity of observation is also very necessary in assisting the entomologist to predict the likelihood of an insect outbreak in a succeeding year and to determine the seriousness of such a possible outbreak. Thus a study of the likely hibernating quarters of the chinch bug in a certain section of the country extending over a large area for several consecutive years is necessary to enable the entomologist, by surveys each autumn, to determine with reasonable accuracy the probabilities of an outbreak of the insect and the extent and degree of the probable infestation in the following season.

McCOLLOCK (J. W.). *Eleodes opaca*, Say, **an important Enemy of Wheat in the Great Plains Area.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 183–194, 1 plate.

The Tenebrionid beetle, *Eleodes opaca*, Say, caused considerable injury in Western Kansas in 1908, since when several well-marked outbreaks have been reported. This "false wireworm" has a wide distribution throughout the Great Plains area, the most severe outbreak occurring in the autumn of 1917, when whole fields were destroyed. The reason that no previous records of injury are available is probably due to the fact that the larvae of this beetle have been mistaken for true wireworms [ELATERIDAE]. The larvae destroy the wheat seed before germination, usually in the autumn, although damage has also been reported in the spring to wheat several inches high. Other food-plants of *E. opaca* are oats, barley, sorghum and maize. It is believed that the adult beetles feed on the wheat heads and grain.

All stages of the insect are described. The duration of the egg-stage varies according to climatic conditions, the average being 9 or 10 days. The larvae moult eleven times. Their habits are subterranean, and they show a preference for dry soil. In the autumn they are found at the bottom of the drill rows and in the spring just beneath the surface of the ground. They also feed on roots and seeds of grasses and on decaying matter and occasionally prey on each other. By October they are practically full-grown and hibernate in this stage. Early in the spring they moult again, and prior to pupation they enter a quiescent state lasting about a week. The total length of the larval stage averages about 317 days.

Pupation occurs in the field during April, May and June, lasting on an average almost 14 days.

The first adults emerge in May and are found in the field until the middle of October, reaching a maximum in August. The normal duration of life is from 2 to 4 months. Pairing usually takes place early in July, followed in a few days by oviposition, the last occasion on which this was observed being in October. The beetle is nocturnal in habits and feeds in the field on evening primrose, Russian thistle and lucerne, and like the larvae they are sometimes cannibals.

A Hymenopterous parasite, *Perilitus eleodis*, Vier., has been reared from *Eleodes opaca*, but the percentage of parasitism has never been high. A Gregarine, *Stylocephalus giganteus*, was found in the alimentary tract of the beetles. In the cages a great many larvae succumbed to a bacterial disease, and the fungi, *Sporotrichum globuliferum* and *Metarrhizium* sp., have been found to attack them.

The cultural methods to control this pest include rotation of crops, summer fallow and delayed planting. A large number of pupae may be destroyed by spring ploughing, thus exposing them to natural enemies and climatic conditions. A poison bran-mash may prove beneficial against the beetles, but all attempts at poisoning the larvae have been unsuccessful.

RICKER (D. A.). **Experiments with Poison-Baits against Grasshoppers.** —*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 194–200.

Climatic conditions play an important part in the efficacy of poison-baits against grasshoppers, and as a result of experiments made in Wisconsin the most favourable conditions appear to be a rather low temperature and high humidity. Various baits were tried, and a table showing their respective efficacy is given. Apples and bananas when used alone or with molasses are slightly more attractive than lemon fruit or lemon extract. A distinct advantage of fruits other than those of *Citrus* is that their odour lasts longer and even increases as fermentation progresses. This fact is of special value with regard to young grasshoppers, as they respond better to a strong-smelling bait.

Paris green, crude arsenious oxide and calcium arsenate were the three poisons tried, the mortality resulting from each of these being nearly the same. In treating tobacco, Paris green caused scorching, but calcium arsenate did not.

The rate of application should depend upon the infestation and the attractiveness of the bait; standard bait used at the rate of 6 to 8 lb. to the acre gave effective results.

DAVIS (J. J.). **The Value of crude Arsenious Oxide in Poison Bait for Cutworms and Grasshoppers.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 200–203.

A summary is given of a number of tests made in different States both in the laboratory and the field demonstrating that crude arsenious oxide is just as efficacious, but much cheaper, in poison-baits than Paris green, provided that it is used in a very finely powdered form [see also this *Review*, Ser. A, vi, p. 396].

HAWLEY (J. M.). **Some Notes on *Phorbia fusciceps* as a Bean Pest.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 203–205, 1 plate.

In 1917 the bean crop in New York State was greatly damaged by *Phorbia fusciceps*, Zett. (seed corn maggot). These Dipterous larvae attack the beans when planted, eating off the plumule or tunnelling in the cotyledons, causing stunted growth and preventing the development of pods.

The eggs are laid on moist, freshly ploughed ground, and on decayed clover and cabbage stems. There are two broods in New York, and sometimes a third. The flies of the first brood appear in May and those of the second at the end of June and beginning of July. The time from egg to adult varies from 25 to 47 days.

Insecticides are useless against this fly as they are harmful to the germinating seeds, but cultural methods offer some prospect of success, especially shallow planting combined with the judicious use of a quick acting fertiliser.

HERRICK (G. W.) & DETWILER (J. D.). **Notes on some little known Pests of Red-clover.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 206–209, 3 figs.

Weevils that occur abundantly in clover fields in New York are :—*Hypera* (*Phytonomus*) *nigrirostris*, F. (lesser clover-leaf weevil), *H.* (*P.*) *meles*, F. (clover-head weevil) and *Tychius picirostris*, F.

The larvae of *H. nigrirostris* live in the heads of clover, into which they tunnel, eating the florets and devouring the ovaries. They sometimes infest the axils of the clover stems also. In these cases the larva eats into the sheath surrounding the bud in the axil, severs the bud from the stem and grooves the side of the main stem. The larvae become full-grown at the end of June and beginning of July, the duration of the pupal stage being from 13 to 16 days.

H. meles has apparently been introduced from Europe; it was first noted in New York in 1907. The eggs are found on and in the stems and leaf-petioles of clover and lucerne, and also on blossoms of clover. The larvae are abundant in the heads of clover, in which the pupae are also found, as well as in the axils of the branches. The pupal stage lasts 12 to 19 days.

Tychius picirostris is also widely distributed in New York State. In Ithaca as many as 19 adults were found in a newly opening head of red clover, apparently feeding on the pollen. This weevil has also been found on pear trees. The larvae feed on the florets, and when full grown, descend into the soil to pupate. The summer brood of adults began to appear about the middle of August.

DEAN (G. A.), KELLY (E. G.) & FORD (A. L.). **Grasshopper Control in Kansas.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, *pp. 213-217, 1 plate.*

A campaign organised to protect the country in the summer and autumn of 1918 from a threatened serious outbreak of grasshoppers is described. The methods adopted included personal visits to the farms and demonstration meetings. At each demonstration the life-history of the grasshopper was explained and bran mash was mixed and distributed with a device for sowing it. In some districts the ingredients for it were supplied from county funds; in others the farmers bought them themselves. The results were very successful in nearly every case. The presence of a large number of eggs of *Melanoplus atlantis* warranted a second campaign in the autumn to protect the wheat crop. It was carried out on similar lines and it was also decided to combine poisoning and autumn disking to destroy the eggs.

The campaign proved a complete success. The value of co-operation was emphasised as much as possible, and many townships decided to carry on the disking as a unit, a special day being set aside for the purpose.

RILEY (W. A.). **A Use of Galls by the Chippewa Indians.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 217–218.

In addition to the uses of insect galls, already recorded [see this *Review*, Ser. A, vi, p. 244], those produced on *Rhus glabra* by an undetermined mite, a species of *Eriophyes*, are stated to be used by the Chippewa Indians in the form of an infusion as a remedy for diarrhoea. This mite is the cause of stunted heads and curled leaves in the food-plant, and is very common in Minnesota.

BRITTON (W. E.). **European Corn Borer in Connecticut.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, p. 218.

Pyrausta nubilalis, Hb., was found in Connecticut in March. Its limits have not yet been ascertained, but prompt measures are being taken to suppress it.

VAN DYKE (E. C.). **A Correction.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, p. 219.

It is now stated that the beetle found feeding on *Azalea* [see this *Review*, Ser. A, vii, p. 37] is *Galerucella rufosanguinea*, Say, and not *G. cavicollis*, Lec.

STOOKEY (E. B.). **A New Root Maggot Treatment.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 2, April 1919, pp. 219–220.

In the course of some experiments for the control of *Phorbia brassicae*, Bch., treatment with green tar oil proved the most effective. Anthracene oil was mixed at the rate of 1 part to 80 parts of soil and scattered as a protecting collar round the base of the plant as soon as it was transplanted. A weaker mixture would probably suffice,

whereas 1 to 20 proved injurious to the plants. One U.S. gall. of the mixture is required for 200 plants. A solution of borax, based on the measures recommended with this substance to kill house-fly larvae proved useless against those of *P. brassicae*.

Henke (*L. A.*). **Corn at the College of Hawaii Farm.**—*Hawaiian Forester & Agriculturist, Honolulu, xvi, no. 2, February 1919, pp. 40–45.* [Received 7th May 1919.]

It is believed that leaf-hoppers [*Peregrinus maidis*] are an important factor in causing stunted growth of maize plants in lower ground in Hawaii, and experiments made to ascertain the relative immunity of certain species of maize to attacks of this kind are described. Cuban maize, although not absolutely immune, offered most resistance to attack. June and Guam maize proved fairly free from leaf-hoppers, but owing to the tendency in these varieties for the husks to open before the harvest, the ears become infested with larvae of the grain weevil, which is very abundant in Hawaii, and the exposed tips are attacked by birds. On Laguna maize, leaf-hoppers were present in great numbers, but did not completely destroy the crop.

Chaine (J.). **Destruction du Puceron du Rosier par les grandes Chaleurs de l'Eté.** [Destruction of the Rose Aphis by the Intense Heat of Summer.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux,* xviii, nos. 3–4, March–April 1919, pp. 23–25.

It is stated that a sudden spell of heat is fatal to Aphids on rose trees. In 1911, a single day of excessive heat resulted in the death of all rose Aphids, and these remained on the trees in a scorched condition. In 1918, the same phenomenon was observed as a result of a long period of high temperature accompanied by excessive drought. In this case the Aphids died off gradually.

Vayssière (P.). **L'Acclimatation des Insectes auxiliaires et son Importance au Point de Vue agricole.**—*Bull. Soc. Nat. Acclimat., Paris,* lxvii, no. 5, May 1919, pp. 137–141.

In discussing the natural methods of control of insect pests, the view is expressed that the method of disseminating parasitic fungi among them, while excellent in theory, leaves much to be desired in practice [see this *Review*, Ser. A, vii, p. 199]. The introduction and propagation of insect parasites has yielded far greater success. Some account is given in the present paper of well-known examples of the successful establishment of such parasites, and the author hopes to encourage further similar introductions into France and her colonies.

Bertrand (G.). **Sur la haute Toxicité de la Chloropicrine vis-à-vis de certains Animaux inférieurs et sur la Possibilité d'Emploi de cette Substance comme Parasiticide.**—*C.R. hebdom. Acad. Sci., Paris,* clxviii, no. 14, 7th April 1919, pp. 742–744.

The idea of utilising as insecticides some of the poison gases employed in the War led the author to experiment with chlorpicrin. This is a mobile liquid that evaporates rapidly and is non-inflammable,

slightly soluble in water, and when mixed with air extremely irritating to the eyes and respiratory organs. When very largely diluted with air it has merely a slightly aromatic and bitter smell. Caution is necessary in its use, but it is less dangerous than hydrocyanic acid gas, which it is possible that it may replace. It is prepared by the action of picric acid on calcium chloride.

In testing its value as an insecticide, a weighed quantity was introduced into a 1 or 2 litre wide-necked flask by means of a capillary pipette delivery in small drops, the flask being then corked and thoroughly shaken to ensure the even distribution of the vapour through the contained air. After a quarter of an hour, the insects to be tested, enclosed in a piece of gauze, were lowered into the middle of the flask, by means of a thread the other end of which was held between the neck and the cork. After a certain exposure, the insects were withdrawn, and, if not dead, were kept under observation upon the foliage of their usual food-plant. In tests with Aphids, a piece of a twig of the food-plant bearing the insects was placed in a tiny flask containing water and the whole was lowered by a thread into the flask.

The insects experimented with included the larvae of such Lepidoptera as *Sparganothis pilleriana* and *Polychrosis botrana*, sawfly larvae and Aphids. The results showed that exposure for from 5–10 minutes in an atmosphere containing 1 to 2 centigrammes of chlorpicrin to the litre was sufficient to kill insect larvae and Aphids either immediately or in the course of a few hours. Larvae exposed to a concentration of half this strength ceased to feed and finally died in 24 to 48 hours. There is thus reason to suppose that chlorpicrin might be used with advantage either as a fumigant, or as a spray in the form of an aqueous solution or emulsion against certain pests of cultivated plants.

JENSEN (H.). **Control of** *Lasioderma serricorne* **and** *Setomorpha margalaestriata*, **injurious to Tobacco in Java.**—*Proefstation voor Vorstenlandsche Tabak, Semarang*, 1917, Mededeeling, no. 30, pp. 1–29. (Abstract in *Mthly. Bull. Agric. Intell. Pl. Dis., Rome*, x, no. 1, January 1919, p. 127.)

The position of the tobacco plantations in Vorstenlanden is not favourable to the beetle, *Lasioderma serricorne*, and the moth, *Setomorpha margalaestriata*, the crop in normal times being kept only for six months or less in sheds that are very clean. Recently the period of storage has been longer owing to lack of shipping, and consequently there has been some danger of infestation. Investigation has shown that carbon bisulphide at the rate of approximately ¼ pint per 35 cub. ft. is sufficient to disinfect the sheds, or benzine may be used, provided that the air is thoroughly saturated with it for 5 or 6 days. The fumes of sulphur dioxide or formalin have no effect upon *L. serricorne*. The tobacco sheds should be protected by mosquito nets.

MACKENNA (J.). **Report on the Progress of Agriculture in India for 1916–17,** *Calcutta*, 1918, pp. 72–84. [Received 9th May 1919.]

The breeding of parasites of cotton boll-worms (*Earias* spp.) was continued [see this *Review*, Ser. A, v, p. 316], the opinion now being held that these belong to the genus *Microbracon* and not to

Rhogas. A weevil, *Myllocerus blandus*, which is a serious pest in young cotton in the Punjab, was successfully dealt with by sowing cotton with maize as a trap-crop. The attacks of a Buprestid beetle, *Sphenoptera gossypii* (cotton stem-borer) have been much lessened by constant destruction of attacked plants.

Among rice pests, *Schoenobius incertellus* (*bipunctifer*) (rice stem-borer) was checked by removal and destruction of plants infested with this moth. The application of oilcakes as a top-dressing in affected fields is recommended. *Spodoptera mauritia* was controlled by pouring kerosene in the water of paddy fields and then dislodging the caterpillars. To destroy *Cnaphalocrocis medinalis* (rice leaf-roller), another Lepidopterous pest of rice, the tips of the plants rolled by it were beaten briskly with a stout cane, thus dislodging and exposing the insects. The crop then received a mulch of a mixture of lime and ashes in the proportion 1:4, after draining away the water wherever possible.

Lepidopterous sugar-cane borers, among which only *Chilo simplex* had hitherto been identified, are now found to include three distinct species of *Diatraea*, others being *Papua depressella*, *Scirpophaga xanthogastrella* (*auriflua*) and *Sesamia inferens*. Of the last two species the former is most injurious to the young stages of sugar-cane, while the second is active throughout the year.

Among miscellaneous pests, *Rhynchophorus ferrugineus* (red palm weevil) did considerable damage to date plantations. The building of mud enclosures round the trunks of the plants and keeping them filled with water proved quite successful. Dropping of oranges was found to be caused by a moth, *Ophideres fullonica*, which also punctures pomelo fruits. Fermenting sugar syrup and lantern traps have been used to attract these moths, but only the latter are of any value.

Some account is also given of the conditions of sericulture and apiculture during the year.

MACKENNA (J.). **Report on the Progress of Agriculture in India for 1917-18,** *Calcutta*, 1919, pp. 85-99. [Received 9th May 1919.]

Investigation into the pests of cotton has shown that *Earias fabia* and *E. insulana* are the most prevalent bollworms at the beginning of the cotton season (July to mid-October), but later on (from October to the end of January) *Pectinophora gossypiella* is most abundant and damages the crop considerably, being at its worst during the picking season. The species of *Microbracon* that parasitises *Earias* spp. is also able to attack the larvae of *P. gossypiella* while these are in the shoots, etc., but seems unable to attack them when they have reached the cotton seeds. It is thought that the control of this pest could best be accomplished by some natural parasite, and since *P. gossypiella* is apparently endemic to India it seems probable that the required parasite, if such exists, might be found there. The best trap-crop for bollworm larvae is *Hibiscus abelmoschus*. Three new parasites of *Earias* spp. have been discovered, a Tachinid attacking the larvae, and a Braconid and a Chalcid infesting the pupae. A serious pest of Cambodia cotton, the stem weevil (*Pempheres* sp.) has recently been recorded in several new localities [see this *Review*,

Ser. A, vii, p. 114]. The method by which infestation is carried over from season to season is not known, nor have preventive measures been discovered.

Most of the stem-borers in rice hibernate in the stubble, while *Schoenobius incertellus* (*bipunctifer*) can be destroyed in the larval stage by ploughing the stubble early in March. *Spodoptera mauritia* was completely checked in many localities by the kerosene method described in the preceding report [see above]. A widespread attack of a beetle, *Hispa* sp., was successfully checked by the use of bags.

In addition to the sugar-cane pests mentioned in the last report, nine other borers not yet known to occur in sugar-cane have been found in wild grasses and are considered to be potential pests of it. Thick canes are more liable to attack by borers than thin ones. Experiments at Pusa show that the cutting away of dead hearts and dry plants with insects in them, which is the treatment usually recommended, retards the proper growth of the cane and is therefore useless.

The Longicorn beetle, *Xylotrechus quadripes* (coffee borer), is being controlled in Mysore by scrubbing the plants twice during the period of emergence of the beetle. In the course of experiments to find a simpler remedy, applications of Brunolinum, a crude distillate from coal-tar, as late as two months after hatching, have been entirely successful, and no injury to the trees has been noticed. Applications made only to the ridges round the stem by means of cotton-wool soaked in this substance also proved quite successful. Experiments will be made to determine whether its application before the emergence of the adult beetles will kill them.

In Mysore, mango hoppers [*Idiocerus*] were found to be largely influenced by temperature, and it is hoped that this discovery may be of practical value in their control, especially as the cost of spraying is excessive. In the Punjab, a Coccid, *Monophlebus* sp., is a serious pest on mango blossoms; bands of cotton wool or grease bands of crude vaseline and rape oil on the trunks have been found effective against it. In Bengal it has been discovered that the mango weevil [*Sternochetus mangiferae*] lays its eggs singly in small depressions on the half-grown fruit, covering them with a black substance. This knowledge, combined with the evidence that the oviposition period is limited to a week or two, ought to render remedial measures practicable. A Psyllid, *Euphalerus citri*, was controlled on citrus trees by regular spraying from March to June with crude oil emulsion and tobacco decoction.

The method of storing grain under a layer of sand was found to be efficacious in protecting it from insect pests. *Tribolium castaneum* is found to do no injury to sound wheat, but breeds profusely in the dust produced in wheat already affected by *Calandra* sp. and *Rhizopertha* sp. *Bruchus chinensis*, which is a pest of stored pulse, is able to breed in the field at Pusa in cow-pea pods. *B. affinis* infesting pea seeds has been considerably checked by drying the seeds in the sun for seven days, even if they are stored for a year afterwards. The treatment of wood infested with termites by soaking in arsenicals or creosote or wood-tar is described.

The condition of the silk and lac industries during the year is also reported on.

BUTLER (E. J.). **The Rice Worm (*Tylenchus angustus*) and its Control.**—*Memoirs Dept. Agric. India (Agric. Research Institute, Pusa)*, Bot. Ser., x, no. 1, January 1919, 37 pp., 4 figs.

A very serious disease of rice, locally called "ufra," is widely distributed throughout the great rice-growing tract at the head of the Bay of Bengal. It is probable that no other plant disease hitherto observed in India, except the cereal rusts that periodically damage wheat, possesses such potentialities for harm. A map shows roughly the limits of the disease as at present known, but its presence is very difficult to detect, as it occurs while the fields are submerged and is at its earliest stage in the winter crop during the time that boat traffic is possible, while the harvest is over when the ground is dry enough to walk on. This disease was discovered in 1912 to be due to a Nematode, *Tylenchus angustus*, which has some similarity of habits with *T. ribes* that causes a serious disease of black currants in England. *T. angustus* apparently feeds exclusively upon living rice. Under normal conditions the worms are active on the plants from June to November in the southern part of the infested tract and rather later in the northern, reproduction being vigorous and all stages of the worm occurring on the plant. The length of the larval stage has not been worked out, nor the rate of reproduction determined but it is undoubtedly high. In swampy ground, where a second growth takes place from the stubble after harvest, this period may be extended to February. In the majority of cases, the host-plant dries up when ripe in late November or early December; the worms then cease feeding, coil up and pass into a resting condition. The influences of such factors as moisture, temperature and light on the longevity and motility of the worms are discussed. Early studies of *T. angustus* led to the conclusion that free liquid was necessary to enable it to wander, but it has now been proved that the worms can move slowly for considerable distances in a saturated or very damp atmosphere.

Observations and experiments have shown that at whatever time rice is sown at Pusa between the beginning of December and the end of March, infestation develops from worms left in the stubble from the previous crop only when the air humidity rises after the rains break in June. When sown early, there is little growth before March or April in Pusa, but the worm is not able to affect appreciably even small plants until the air humidity rises enough to allow it to climb up to the parts above-ground. There is evidently no inherent inability in the worms to attack rice during this period, since infestation has been secured in the laboratory by keeping the plants covered with a bell-jar. It is practically certain that the worms occur in the water of low-lying areas in the early months of the year and probably a number of them reach the growing spring paddy and get carried up or climb up above the water during the heavy night-dews of January and February. Those that do not leave the water are probably all dead a month or two after the fields are flooded. While in the water they do not multiply, and after they leave it multiplication can probably only proceed to a limited extent before the air becomes too dry to allow of pairing. After February or March no further migration of *T. angustus* is possible and the spring paddy, though

the plants may bear desiccated worms in the lower parts, escapes the injury to the ears and upper part of the stem that causes such losses in the later crops, and is harvested before the break of the rains would allow of further infestation. In the same way, the autumn paddy does not become severely attacked until June (infestation probably taking place in May), though worms must be present in the water of the lower-lying tracts from the first flooding of the fields. The winter paddy (the main crop) is doubtless attacked at the same time, but the attack escapes notice as the crop is still very immature. That the damage to the winter crop is so much greater than to the autumn one is probably due to reproduction only being possible after the rains break, that is, shortly before the autumn crop is harvested, while it continues for several months during the maturing of the winter one.

T. angustus can only feed on certain parts of the plant; these include the young ear, the peduncle, the part of the stem just above the upper nodes, the leaf-sheath and the young leaf-blades inrolled towards the centre of the bud above the growing point. It is not until the ear is forming and the worms collect at its base and above the top nodes of the stem that the strain becomes more than the plant can meet. It is quite possible to keep even severely infested young plants growing, but often impossible to get them to bear mature ears.

Many inoculation experiments carried out at Pusa are described. These indicate that the disease only develops during the monsoon, unless the plants are covered so that they grow in a saturated atmosphere. The question of soil and seed infestation are discussed; it is considered that infested matter does not remain in the soil if all the stubble be removed; infestation may under certain conditions be carried by the seed, though this is unusual. The relative immunity of transplanted paddy is chiefly because transplantation is made on to high ground that is dry during the greater part of the year. There is as yet no indication that any variety of paddy is naturally resistant to the attacks of this Nematode, though some varieties do not give sufficient time between infestation and harvest to allow of much multiplication of the worms, while other early maturing varieties are well advanced before the disease usually begins. Unless there exists a variety with such thickened or hardened outer cell-walls that the mouth-parts of the worm cannot pierce them, it is unlikely that immune varieties will be found.

Suggestions for improvement in rice-growing include the introduction of early maturing kinds, and the re-arrangement of the levels of particular fields so that transplanted winter or spring crops can be grown in place of long-stemmed winter ones. The growing of jute in some classes of infested land has been advocated with the idea that if the paddy crop could be replaced even for a year the worms would die out. Another practice is to take first a crop of jute and follow it by a crop of transplanted winter rice put in in August. This cannot be done on the lowest land. The problem is more an agricultural than a pathological one. It has been conclusively proved that the destruction of the stubble of the winter rice will alone effect a great improvement, while if this can be followed by ploughing and keeping the field dry for two or three months the worms can be completely destroyed. The methods must vary in

each locality according to the conditions, and anyone who is acquainted with those of rice cultivation in Eastern Bengal, the enormous area concerned, the lethargy of the cultivators, the difficulties of communication and other factors, will realise that progress is bound to be slow, particularly while the numbers of trained assistants are so inadequate.

BEESON (C. F. C.). **The Food Plants of Indian Forest Insects. Parts I and II.**—*Indian Forester, Allahabad*, xlv, nos. 2–3, February and March 1919, pp. 49–56 and 139–153.

These lists of food-plants of Indian forest insects form part of a series of annotated lists of those species of which the food-plants are known, with their distribution and feeding habits. The data obtained are largely incidental to investigations carried out on a few of the principal timber trees, the records being for the most part new.

Some of the more important Coleopterous insects dealt with include the Anthribids, *Araecerus fasciculatus*, De G., in *Areca catechu* and in Papilionaceae; *Eucorynus crassicornis*, F., in *Shorea robusta* and *Terminalia tomentosa*; *Phloeobius apicalis*, Wlk., in *Xylia dolabriformis*; *Physopterus agrestis*, Boh., in *S. robusta*; *Xylinades plagiatus*, Jord., in *S. robusta* and *X. dolabriformis*; the Bostrychids, *Apate submedia*, Wlk., in *Casuarina equisetifolia*; *Bostrychopsis parallela*, Lesne, in *Dendrocalamus strictus*; *Dinoderus brevis*, Horn, in *D. strictus* and *S. robusta*; *D. distinctus*, Lesne, in *Mangifera indica*; *D. minutus*, F., and *D. pilifrons*, Lesne, in *D. strictus* and bamboos; *Heterobostrychus aequalis*, Waterh., in *Bombax malabaricum*, *D. strictus*, *S. robusta* and other plants; *H. pileatus*, Lesne, and *H. unicornis*, Lesne, in *S. robusta*; *Sinoxylon anale*, Lesne, in *Acacia catechu*, *M. indica*, *S. robusta* and other plants; *S. atratum*, Lesne, in *A. catechu* and *Anogeissus latifolia*; *S. capillatum*, Lesne, in *Albizzia lebbek*, *S. robusta* and other plants; *S. crassum*, Lesne, in *A. catechu* and *Albizzia procera*; *Xylodectes ornatus*, Lesne, in *Acacia catechu* and *Terminalia belerica*; *Xylopsocus capucinus*, F., in *M. indica*; *Xylothrips flavipes*, Ill., in *M. indica*, *S. robusta* and *Theobroma cacao*; the Brenthid, *Hormocerus reticulatus*, Lund, in *Bombax malabaricum* and *Castanopsis tribuloides*; the Bruchid, *Caryoborus (Pachymerus) gonager*, F., in *Bauhinia malabarica*, *B. racemosa*, *Cassia* spp., *Casuarina equisetifolia*, *Prosopis juliflora* and *Tamarindus indica*; the Buprestids, *Acmaeodera kerremansi*, Stebb., in *Dalbergia sissoo*; *A. stictipennis*, C. & G., in *Bauhinia vahlii* and *S. robusta*; *Agrilus birmanicus*, Kerr., in *D. sissoo*; *Ancylocheira geometrica*, C. & G., in *Pinus longifolia*; *A. kashmirensis*, Fairm., in *Cedrus deodara*; *Anthaxia notaticollis*, Chevr., and *A. osmastoni*, Stebb., in *Pinus longifolia*; *Belionota prasina*, Thunb., in *Mangifera indica*, *Psidium guyava* and other plants; *Capnodis indica*, Thoms., in *Eugenia jambolana* and *Pinus longifolia*; *Chrysochroa (Megaloxantha) bicolor*, F., in *Theobroma cacao* and *Xylia dolabriformis*; *Chrysobothris indica*, C. & G., in *Shorea robusta* and *Terminalia tomentosa*; *C. quadraticollis*, Kerr., in *T. tomentosa*; *C. sexnotata*, Gory, in *S. robusta*; *Psiloptera (Lampetis) fastuosa*, F., in *Acacia arabica* and *Tectona grandis*; *P. (L.) viridans*, Kerr., in *Shorea robusta* and *T. tomentosa*; *Sphenoptera aterrima*, Kerr., and *S. lafertii*, Thoms., in *Cedrus deodara*;

the Cerambycids, *Acanthophorus serraticornis*, Oliv., in *Mangifera indica* and *S. robusta*; *Aegosoma costipenne*, White, in *Tectona grandis*; *Aeolesthes holosericea*, F., in *Acacia arabica*, *Butea frondosa*, *Cedrela toona*, *Pinus longifolia*, *S. robusta* and other plants; *Aeolesthes sarta*, Solsky, in *Platanus orientalis* and other plants; *Ceresium nilgiriense*, Gahan, in *Shorea robusta*; *C. zeylanicum*, White, in *Heritiera fomes* and *S. robusta*; *Criocephalus tibetanus*, Sharp, in *Cedrus deodara* and *Pinus gerardiana*; *Derolus volvulus*, F., in *Bombax malabaricum*, *S. robusta* and *Xylia dolabriformis*; *Dialeges pauper*, F., in *Milletia auriculata* and *S. robusta*; *Diorthus cinereus*, White, in *Bauhinia vahlii*, *Heritiera fomes* and *S. robusta*; *Euryphagus lundi*, F., in *S. robusta*; *Gelonaetha hirta*, Fairm., in *H. fomes* and *Tectona grandis*; *Hoplocerambyx spinicornis*, Newm., in *Shorea obtusa*, *S. robusta* and other plants; *Hypoeschrus indicus*, Gahan, in *S. robusta*; *Lophosternus hugelii*, Redt., in *Pyrus malus*, *Quercus ilex* and *Q. incana*; *Leptura rubriola*, Bates, in *Cedrus deodara* and *Picea morinda*; *Macrotoma crenata*, F., in *Quercus dilatata* and *Bombax malabaricum*; *M. plagiata*, Waterh., in *Heritiera fomes*; *Nothorhina muricata*, Dalm., in *Pinus longifolia*; *Nyphasia apicalis*, Gahan, in *S. robusta*; *Perissus mutabilis*, Gahan, in *S. robusta*; *Plocaederus obesus*, Gahan, in *B. malabaricum*, *Butea frondosa* and *S. robusta*; *Purpuricenus montanus*, White, in *Pinus excelsa*; *Rhytidodera robusta*, Gahan, in *S. robusta*; *Stromatium barbatum*, F., from a large number of food-plants; *S. longicorne*, Newm., in *Tectona grandis*; *Tetropium oreinum*, Gahan, in *Cedrus deodara*; *Xylotrechus buqueti*, C. & G., in *Shorea robusta*; *X. gahani*, Steb., in *Ficus elastica*; *X. smei*, C. & G., in *Butea frondosa*, *Shorea robusta* and other plants; *X. quadripes*, Chevr., in *Tectona grandis* and *Coffea robusta*; *Xystrocera globosa*, Oliv., in *Albizzia lebbek*, *Bombax malabaricum* and other plants.

DE (R. N.). **Simul Plantations in Jhums in Assam.**—*Indian Forester, Allahabad*, xlv, no. 3, March 1919, p. 156.

In a recent paper on the cultivation of simul (*Bombax malabaricum*) in Assam, the only damage recorded as being caused by any insect pest was that by an unidentified Longicorn larva. This has subsequently been identified as a Lamiid, *Glenea spilota*, Thoms.

CHASE (W. W.). **Common Insects and Diseases of the Apple.**—*Georgia State Bd. Entom., Atlanta*, Bull. no. 54, March 1919, 51 pp., 12 plates. [Received 12th May 1919.]

This bulletin is a revision of a previous one [see this *Review*, Ser. A, i, p. 451]. Improvements on the older methods and modifications of spraying practices and materials are incorporated in the present issue. A condensed spray-schedule for apples is given.

COSSETTE (J. R.). **Two Years of Success with Dusting.**—*Canadian Hortic. and Beekeeper, Toronto*, xxvii, no. 4, April 1919, p. 101.

Dusting has been practised for two years at an agricultural institute in Quebec, and is pronounced a success. Details of the sprayings and the results obtained are given. The treatment was chiefly for the bud-worm [*Eucosma ocellana*] and for apple-scab, the powders

used being lead arsenate, sulphur and talcum. While easier to apply than lime-sulphur wash, and giving at least equally good results, the dusting method has the disadvantage of being expensive. It has been decided to continue dusting at the institute, and it is hoped to demonstrate the ultimate economy of this method.

WEISS (H. B.) & NICOLAY (A. S.). **Notes on *Zeugophora scutellaris*, Suffr., a European Poplar Leaf-miner, in New Jersey (Col).**—*Entom. News, Philadelphia, Pa.*, xxx, no. 5, May 1919, pp. 124–127, 1 fig.

This Chrysomelid beetle was found in a New Jersey nursery on *Populus deltoides*. The different stages are described. The eggs are deposited on the leaves, of which the emerging larvae mine the tissues in July; they are full-grown by August and drop to the ground to pupate, though this probably does not take place until the following spring. The adults appear early in the summer and feed on the poplar leaves, the terminal ones being preferred and becoming completely skeletonised. This combined mining and feeding results in complete destruction of the foliage.

GAGE (J. H.). **The Staining of Coccids (Homop.).**—*Entom. News, Philadelphia Pa.*, xxx, no. 5, May 1919, pp. 142–143.

As a result of experiments with various stains for COCCIDAE and allied insects, säurefuchsin 0·5 gram., 10 per cent. hydrochloric acid, 25 cc. and distilled water 300 cc. is recommended. Full particulars of the methods of procedure are given.

DAVIS (J. J.). **Grasshopper Control in Indiana.**—*Purdue Univ. Agric. Expt. Sta., Lafayette, Ind.*, Circ. no. 88, January 1919, 8 pp., 9 figs. [Received 15th May 1919.]

The measures against grasshoppers suggested as suitable for the conditions in Indiana are egg destruction in the autumn and winter by ploughing to a depth of 6 inches, and the use of poisoned bran or sawdust baits for killing the adults and young hoppers. The following formula is given. Bran, bran and sawdust in equal proportions, or sawdust alone 25 lb., Paris green, crude arsenious oxide or white arsenic 1 lb., molasses 2 U.S. qts., 6 lemons, bananas or oranges or one ounce of lemon extract, water 1 to 2 U.S. gals.; from seven to ten pounds of this bait are required per acre.

The grasshoppers may also be collected by means of grasshopper catchers, and in this case they can be utilised as food for poultry. This method is described.

Reports on the State of the Crops in each Province of Spain on the 20th April 1919.—*Bol. Agric. Técnica y Económica, Madrid*, xi, no. 124, April 1919, pp. 341–356.

In Cordova oaks are already showing infestation with *Tortrix viridana*, and it is feared that the acorn crop, as in previous years, will be almost completely destroyed. In Huelva, spring-sown vegetable crops are being somewhat damaged by *Aphis fabae.* Oak trees are being attacked by *Porthetria* (*Liparis*) *dispar*. Locusts are causing considerable damage, although occurring within a limited

area; it is hoped that sufficient insecticides will soon be received to deal successfully with this outbreak. Olive trees in Málaga are attacked by various pests, including *Phloeotribus scarabaeoides* (oleae) and *Saissetia oleae.*

GURNEY (W. B.). **The Insect Pests of Maize.**—*Agric. Gaz. N.S.W., Sydney,* xxx, no. 3, March 1919, pp. 196–202, 1 plate, 4 figs.

The formula here recommended against cutworms has already been given [see this *Review*, Ser. A, vii, p. 262]. The substitution of 9 oz. of white arsenic for 1 lb. of Paris green has been suggested; six lemons or oranges chopped finely and added to the mixture increase its attractiveness for cutworms. Maize tops, potato haulms, turnip tops etc. soaked for about 5 minutes in 1 lb. of Paris green to 10 gals. water, have proved successful as baits in South Africa.

The following additional maize pests [see this *Review*, Ser. A, vii, p. 84] are recorded. *Euxoa* (*Agrotis*) *radians*, Guen., also occurring on lucerne, vegetables, and other crops; *Prodenia litura*, F., attacking all the above as well as weeds and *Lantana*; and the pumpkin beetle, *Aulacophora olivieri*, which attacks the leaves and silks of maize. In the north coast river districts one of the most serious pests is a Chrysomelid, *Monolepta rosae*, Blackb., which attacks the silk of the maize cob as well as citrus and many other fruits of which the blooms and young foliage are injured. During the winter these beetles have been known to swarm on *Acacia* spp. The pepper tree is attacked both in winter and summer. A list is given of dates of appearance on different food-plants from March 1918 to February 1919.

Various remedial measures have been tried and so far as the present experiments go, a spray that quickly dislodges the beetles and enables them to be further sprayed on the ground seems likely to be the most satisfactory.

FROGGATT (W. W.). **The Seedling-gum Moth** (*Nola metallopa*, **Wlk.**). **Extensive Damage to Red Gum Forests.**—*Agric. Gaz. N.S.W., Sydney,* xxx, no. 3, March 1919, pp. 203–206, 5 figs.

The caterpillars of a Lithosiid, *Nola metallopa*, are reported to have been causing severe damage to *Eucalyptus rostrata*. They feed on the green leaves and cause withering of the branches and twigs. A description is given of the various stages.

FROGGATT (W. W.). **Notes on Australian Sawflies (Tenthredinidae).**—*Proc. Lin. Soc. New South Wales,* xliii, no. 3, 30th October 1918, pp. 668–672.

In Australia the gregarious larvae of several species of the genus *Perga* are common at certain seasons, especially March and April, feeding on the foliage of young *Eucalyptus* trees, but the perfect insects are comparatively rare, since the larvae are attacked by many Dipterous and Hymenopterous parasites. *Perga dorsalis*, Leach, has an extended range round the coast and is common in Victoria and New South Wales. The gregarious larvae feed at night and rest during the day, those that pupate in the soil in the middle of April having been found to produce adults in the early part of

October. *Pterygophorus bifasciatus*, Brullé, is described from specimens bred from cocoons that were imbedded in the soft wood of the stem of an undetermined tree, the adults emerging early in September. The larva of *Philomastix macleayi*, Westw., occurs on wild raspberry plants. *Pterygophorus analis*, Costa, appears in early summer in the open forest country in enormous numbers, the eggs being deposited on the foliage of iron bark-trees. The resultant larvae completely defoliate the trees, and when fully fed, they crawl or fall to the ground and congregate at the base of the tree-trunks in regular heaps in the month of August. Cattle running in infested country have acquired the habit of licking up these larvae with the result that as many as 20 per cent. of a herd have died within a week from what appears to be acute intestinal inflammation.

BRUES (C. T.). **A new Chalcid-Fly parasitic on the Australian Bull-dog Ant.**—*Annals Entom. Soc. America, Columbus, Ohio*, xii, no. 1, March 1919, pp. 13–21, 2 plates. [Received 15th May 1919.]

Psilogaster fasciiventris, sp. n., a parasite of *Myrmecia forficata*, F. (Australian bull-dog ant) is described.

ILLINGWORTH (J. F.). **Monthly Notes on Grubs and other Cane Pests.**—*Queensland Bur. Sugar Expt. Stns., Brisbane*, Div. Entom. Bull. no. 7, 1917–1918, 29 pp. [Received 16th May 1919.]

This bulletin comprises a resumé of various reports that have already been noticed [see this *Review*, Ser. A, vi, pp. 495, 526, etc.].

ILLINGWORTH (J. F.). **The Sugar-Cane Beetle.**—*Queensland Agric. Jl. Brisbane*, xi, no. 3, March 1919, pp. 120–121. [Received 19th May 1919.]

A large emergence of *Lepidiota albohirta* and *L. frenchi* occurred in December. Observation showed that numerous species of birds are of assistance in keeping these beetles in check. The Noctuid, *Phragmatiphila truncata*, Wlk., is reported on sugar-cane in great numbers on one estate. In many cases the galleries of the borer were cleared by an ant, *Pheidole megacephala*.

TRYON (H.). **The St. Johns' Wort Pest. Proposal to utilise Insect Enemies for its Eradication.**—*Queensland Agric. Jl. Brisbane*, xi, no. 3, March 1919, pp. 122–123. [Received 19th May 1919.]

The suggestion that *Chrysomela hyperici*, Forst., should be introduced into Australia to control this weed (*Hypericum*) has met with strong opposition from the agricultural authorities in Victoria and experts in South and Western Australia. The author is however in favour of its introduction.

WATTS (F.). **Concerning Cotton in St. Vincent and the Steps which must be taken to safeguard the Industry.**—*West Indian Bull., Barbados*, xvii, no 3, 1919, pp. 167–176.

One of the principal diseases causing the loss of cotton in St. Vincent is that known as internal boll rot, which is conveyed to and disseminated

among the cotton plants by cotton stainers [*Dysdercus*] and also by bush-bugs such as *Nezara viridula*. Further investigations are necessary in connection with *N. viridula* and other insects causing indirect attacks of disease on cotton and it is hoped that, as investigations proceed, means for combating the attacks will be found. Steps have already been taken to control by legislation and inspection the times of sowing of cotton seed and the destruction of the old cotton bushes at the end of each season, so that there shall be a period in each year during which no cotton plants exist, thus depriving both insect and fungus enemies of the means of surviving from one season to another. Many leguminous crops are preferred food-plants of these bugs, and, if these are abruptly destroyed, the insects then invade the cotton in large numbers, probably carrying the disease with them. Leguminous crops should therefore be so timed that they may not have to be removed at a period when there is cotton that might become infected.

HARLAND (S. C.). **The Inheritance of Immunity to Leaf-Blister Mite (*Eriophyes gossypii*, Banks) in Cotton.**—*West Indian Bull., Barbados*, xvii, no. 3, 1919, pp. 162–166. [Received 19th May 1919.]

The question of the immunity of certain types of cotton to *Eriophyes gossypii* has been discussed in a previous paper and some account has been given of crossing immune and susceptible varieties [see this *Review*, Ser. A, v, p. 109]. The present paper contains an account of the results of the F/1, F/2 and F/3 generations of a cross between the immune type, St. Vincent native, and the susceptible type, Southern Cross Upland. The F/1 was intermediate, though inclining towards the susceptible parent. In F/2, segregation occurred into immune and non-immune. In F/3 immune bred true, while non-immune segregated into immune and non-immune. The economic importance of the discovery that strains of cotton immune to the attacks of *E. gossypii* can be obtained is obvious, as it opens up the way to the production of immune strains of Sea Island cotton. The nature of this immunity is briefly discussed.

BALLOU (H. A.). **The Poisoning of the Boll Weevil.**—*Agric. News, Barbados*, xviii, no. 443, 19th April 1919, pp. 122–123.

Owing to the success of experiments in the United States to control the Mexican boll-weevil [*Anthonomus grandis*] on a large scale by means of poisons, particulars are given as to the method adopted and machinery used.

The poison recommended is a calcium arsenate containing not less than 40 per cent. arsenic pentoxide and not more than 0·75 per cent. of water-soluble arsenic, and of a density not less than 80 cubic inches per lb. The poison is applied in the form of a dust, 6 lb. being required per acre for each application. The fields should be sprayed from two to four times during the season; in the event of heavy rain within 24 hours, the dusting should be repeated. The best time to apply

the poison is when the leaves are damp and the air calm. The power duster recommended should be able to cover at least 6 acres an hour, whereas the capacity of each hand dust-gun is about 5 acres per day.

DAVIDSON (W. M.). **Life History and Habits of the Mealy Plum Aphis.** —*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 774, 28th April 1919, 16 pp., 2 plates.

Hyalopterus arundinis, F. (mealy plum aphis) in California is injurious to plums, prunes and, in a lesser degree, to apricots, causing early dropping and small-sized fruits and probably, to some extent, the apical cracking of prunes. The winter eggs hatch in early March and stem-mothers begin reproduction about 20th March. There are normally from 3 to 5 spring generations, the earlier ones being wingless, while practically all produced after mid-June develop wings, though wingless generations have been known to persist until the autumn. Migration to the summer food-plants, *Phragmites* sp. (reed grass) and *Typha latifolia* (cat-tail rush) continues from April till August [see this Review, Ser. A, v, p. 229, etc.]. About the middle of October winged sexuparous migrants are produced; these fly to the fruit-trees where sexual females are deposited. Oviposition occurs in November and December.

Internal parasites of *H. arundinis* seem to be very rare, but there are many natural enemies. Eggs of Syrphids and Chrysopids were observed as early as 17th March deposited near the stem-mothers on plums. Lampyrid beetles appeared locally throughout April, while in May Syrphid larvae, especially those of *Lasiophthicus* (*Catabomba*) *pyrastri*, L., and Coccinellids, chiefly *Hippodamia convergens*, Guér., were abundant, and a few Hemerobiid larvae were observed. The colonies on *Typha* were preyed upon by Syrphid larvae, and those on *Phragmites* by Coccinellid beetles and by larvae of *Leucopis* sp.; in late autumn the sexual females were attacked by Syrphids and by *Triphleps*.

The use of contact insecticides against the growing stem-mothers in early spring and against the sexual females developing on the winter hosts in late autumn should be effective, though they are of little use against the indiviudals of the intermediate generations.

WHITING (P. W.). **Sex-determination and Biology of a Parasitic Wasp, *Hadrobracon brevicornis* (Wesmael).**—*Biol. Bull. Marine Biol. Lab. Woods Hole, Mass.*; *Lancaster, Pa.*, xxxiv, no. 4, April 1918, pp. 250–256, 1 fig. [Received 20th May 1919.]

The individuals of the Braconid, *Hadrobracon brevicornis*, mate readily as soon as they emerge from the cocoon, and the females oviposit upon the bodies of mature caterpillars of *Ephestia kühniella*, Z., (Mediterranean flour-moth), and probably also upon other caterpillars infesting flour, etc. Several eggs are laid upon one caterpillar and as many as 10 or 12 parasites may sometimes develop from it, though the number is usually smaller. At a high temperature the length of a generation is 10 days or less. The adult females may live as long as 6 weeks.

Sex-determination experiments showed that in *H. brevicornis* fertilised eggs produce females and unfertilised eggs produce males,

not a single female having been produced from a virgin female. In the case of *Lysiphlebus tritici* virgin females occasionally produce a few females in addition to males.

Investigations at the United States Parasite Laboratory indicate that males are usually produced from virgin females of Braconids and Ichneumonids, but that in the case of *Hemiteles*, an Ichneumonid hyperparasite, both sexes are produced parthenogenetically.

PATTERSON (J. T.). **Studies on the Biology of** *Paracopidosomopsis.* **IV. The Asexual Larvae.**—*Biol. Bull. Marine Biol. Lab., Woods Hole, Mass.*; *Lancaster, Pa.*, xxxv, no. 6, December 1918, pp. 362–371. [Received 20th May 1919.]

Silvestri reported in 1906 the discovery of a peculiar type of larva in the Chalcid, *Litomastix truncatellus*, Dalm., which he regards as asexual. According to him the egg of *Litomastix* produces a thousand or more sexual larvae and a variable number of so-called asexual larvae. The former undergo metamorphosis and produce adult insects of both sexes, and the latter, which are characterised by the absence of certain important organs, including the reproductive system, die without undergoing metamorphosis. It has been suggested that these two forms really belong to two very different parasites, as the asexual larvae closely resemble certain very young Ichneumonid larvae. Further, it has been argued that as in many Chalcids larvae of the sexual type are able to break down and assimilate the tissues of their host, it is improbable that a single species should have developed a peculiar sexless and moribund larva for this particular purpose.

Paracopidosomopsis floridanus, Ashm., which is very similar to *L. truncatellus*, oviposits in the egg of *Phytometra* (*Autographa*) *brassicae* (cabbage looper), the parasitic egg developing in the body cavity or tissues of the host caterpillar. By the time this is ready for pupation the larval parasites have consumed its entire contents, leaving only the skin of the host. In studying the development of the larvae of *P. floridanus* only those host caterpillars were used that had been reared under experimental control in the laboratory to ensure their freedom from other parasites. Under these conditions it was found that the parasitic egg produces asexual as well as sexual larvae, irrespective of whether or not the female parent has paired. The time that elapses between the laying of the egg and the emergence of the adults is about 28 to 30 days in August and September, and about 40 to 45 in the cooler months of October and November.

Dissections of a large number of infected caterpillars 12–15 days old, revealed the presence of asexual larvae in nearly every case. It is probable that in a few cases no asexual larvae are developed, and it is difficult to determine the exact number produced by a given egg since they are formed continuously from the 3rd to the 15th day, and those first developed degenerate before the last ones appear. Apparently they do not live more than a very few days after being set free in the body cavity, and seem to perform no function, there being no evidence that they break down the tissues of the host and thus prepare it for assimilation by the sexual larvae.

SHINJI (G. O.). **A Contribution to the Physiology of Wing Development in Aphids.**—*Biol. Bull. Marine Biol. Lab., Woods Hole, Mass.*; *Lancaster, Pa.*, xxxv, no. 2, August 1918, pp. 95–116. [Received 20th May 1919.]

The author's summary of this paper is as follows:—(1) Either an apterous or an alate parthenogenetic female may bear young larvae, some of which may finally attain the winged condition, while others may remain wingless throughout life. (2) When newly born Aphids were reared on rose twigs planted in tumblers containing washed and sterilised sand that had previously been saturated with the solution of a certain substance, nearly 100 per cent. of winged individuals appeared on the twigs, while either none or few winged forms developed on the twigs charged with any one of another set of chemicals. (3) As far as the tests go, the salts of the alkalis and alkaline earths with the exception of magnesium, distilled water, urea, alum and others were shown to belong to the non-wing-developing substances, while the salts of the heavy metals and of magnesium, sugar and perhaps some others, belong to the category of wing-developing substances. (4) The wing-developing substances were only effective when applied within a certain period after birth. This period varied with temperature and also with the species, *e.g.*, the maximum time for the rose aphis, *Macrosiphum rosae*, L., during the early summer was found to be from 2–3 days, while under the same conditions from 5–7 days was the maximum in the case of *M. solanifolii*, Ashm., *Aphis brassicae*, L., etc. (5) The amount of magnesium salts and also of other wing-developing substances needed to produce winged Aphids was very small. Subjection to a m/100 solution of magnesium sulphate for 12–24 hours produced nearly 100 per cent. of winged Aphids, so far as *M. rosae* was concerned. (6) When twigs planted in the sand saturated with distilled water and calcium chloride were subjected to a drying process, the young Aphids born on these twigs remained apterous, whereas on those that had been charged with solutions of magnesium salts or some other wing-developing substances, the greatest number of the winged Aphids appeared. (7) When newly born Aphids are subjected to a mixed solution of wing-developing and non-wing-developing substances, winged Aphids may or may not appear, according to whether or not the solution contains an excess of the wing-developing over the non-wing-developing substances. (8) Variation in temperature, or a sudden change from as high as 100° F. to as low as 35° F., failed to produce winged Aphids on the twigs charged with non-wing-developing substances.

The popular conception that the approach of cold weather makes winged Aphids appear may be explained by the fact that plants mature at this time and in so doing manufacture starch which is changed into sugar for transference to storage organs, and this sugar is the most common wing-developing substance.

SWAINE (J. M.). **The Balsam Injury in Quebec and its Control.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 3, March 1919, pp. 227–233, 3 figs. [Received 21st May 1919.]

About 10 years ago, an outbreak of the spruce bud-worm [*Tortrix fumiferana*] developed in the province of Quebec, affecting the spruce

and balsam forests, and lasting for 3 or 4 years. The caterpillars fed chiefly upon the buds and outer foliage of spruce, especially upon the upper part of the crown, making the trees appear scorched, but usually leaving enough foliage to carry the trees over the outbreak. The results were almost complete cessation of annual growth during the outbreak, the death of many tops, and attacks by bark-beetles.

The injury to balsams was much more severe, thousands of trees being killed outright as a direct result of defoliation, and other weakened balsams being attacked by parasitic fungi and two bark-boring beetles. The more destructive of these is the Eastern balsam bark-beetle [*Ips balsameus*, Lec.], the adults and larvae of which tunnel between the bark and the sapwood, checking the flow of sap and killing dying and weakened trees. When very abundant, it may even attack green timber, though it mainly breeds in slash and fire-killed trees. The other is the Eastern balsam weevil [?*Pissodes dubius*, Rand.] which oviposits in the green or dying bark, the eggs being laid singly in punctures made in groups. It is a pest new to the Province, but since it has been spreading rapidly, it will doubtless prove a serious enemy to balsam.

Suggested remedial measures consist in utilising the threatened balsam, since the dying trees are riddled by large boring grubs which results in their death by the end of the second season; and chiefly in burning the balsam slash, which will not only check the injury in and near the infested areas, but will greatly improve the conditions for the next crop. It has been discovered that in mixed sections of spruce and balsam, the higher the percentage of balsam, the heavier the budworm injury to both balsam and spruce; therefore if the percentage of spruce can be increased two most important results, the production of more valuable wood and more healthy trees, will be attained.

CHRYSTAL (R. N.). **The Poplar Borer (*Saperda calcarata*, Say).**—*Agric. Gaz. Canada, Ottawa*, vi, no. 4, April 1919, pp. 333–337, 4 figs.

Saperda calcarata has been reported from many parts of the United States as a serious pest of many species of poplar, and in Canada occurs all across the continent from Nova Scotia to Vancouver. An outbreak recorded in 1912 in S. Carolina resulted in the destruction of several hundreds of Carolina poplars, the damage being discovered only after several of the affected trees had been broken off by the wind 7 to 9 feet above the ground.

The adult beetles occur on the trunks and branches of poplars during August and September, the eggs being laid in crevices of the bark. The young larvae feed for a short time between the inner bark and outer sap-wood, tunnelling into the wood on the approach of cold weather. The life-cycle probably requires 3 years for its completion during which time large irregular galleries are excavated in the heart-wood. The pupal stage, which lasts several weeks, is passed near the centre of the trunk or branch. The outward evidence of damage consists in scars on the trunk and branches, sometimes black and swollen, and sometimes exuding a quantity of sap, which attracts butterflies, wasps, bees and other insects.

In dealing with outbreaks of *S. calcarata* on a large scale, the only practical method is the cutting out and burning of more than 75 per cent. of the worst affected trees, which should be done in winter when the wood may be used for fuel. Dead trees are a menace only in so far as they afford a breeding-ground for other harmful wood-boring insects. If not finished during the winter, this work should be completed by July to ensure the destruction of pupae and adults.

In order to protect valuable ornamental trees in parks and gardens a repellent wash to prevent oviposition should be used, the best consisting of 1 gal. soft soap dissolved in 6 gals. saturated solution of washing soda, 1 pint of carbolic acid being added and thoroughly mixed; enough lime slaked in 4 gals. water should be added to form a thick whitewash and ½ lb. Paris green should be mixed in thoroughly. Young larvae burrowing in the cambium can be mechanically removed by a sharp knife or bent wire, or carbon bisulphide may be sprayed into the burrows by an atomizer, the holes being immediately lightly sealed with putty.

TOTHILL (J. D.). **The Meaning of Natural Control.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro*, February 1919, pp. 10-14. [Received 21st May 1919.]

The influence of natural control in the case of a few well-known insects is discussed. The factors of control are divided into two classes, those that restrict an animal or plant to certain geographical ranges, such as oceans, deserts, mountains, climate, etc., and those that effect the increase or decrease of an organism within its natural range; the latter group comprise such factors as are dealt with in the present paper. A table shows the chief of these as concerning Lepidopterous insects. Parasites that limit insect abundance are of various kinds and include protozoal and bacterial diseases, fungous epidemics, Nematodes, predaceous mammals, birds and insects and insect parasites. Typical instances are given of outbreaks of *Malacosoma disstria* (forest tent caterpillar) and *Hyphantria* sp. (fall webworm) and of the various factors that influence their control. It is pointed out that insect parasites and predators occupy a somewhat peculiar position in that they can overtake a numerically increasing host and so have a regulative effect not possessed by any other factors. They are also the only factors that can be manipulated by human beings, and therein lies the possibility of preventing outbreaks of certain injurious insects. The present outbreak of *Hyphantria* sp. in Nova Scotia is undoubtedly due to a scarcity of the two chief parasites, *Varichaeta* sp. and *Limnerium* sp., and might have been prevented by the introduction of large numbers of these four or five years ago from New Brunswick, where they could have been collected in large numbers. In Alberta *M. disstria* has been occurring in great abundance for three years and no parasite could be found in either larvae or pupae during last year or the present year; these outbreaks might have been prevented by introducing about four years ago numbers of *Limnerium* sp. or *Blepharipeza* sp. from either the Atlantic or Pacific provinces, where they are abundant. *Lepidosaphes ulmi* (oyster-shell scale) is largely controlled in North America by a mite, *Hemisarcoptes*. This scale reached British Columbia many years ago, but

the mite was left behind. It has consequently been increasing steadily and in some localities is very abundant; had the mite been liberated in the early centres of infestation, the present situation with regard to the scale would probably be much less serious than is actually the case.

BRITTAIN (W. H.). **Further Notes on the Apple Maggot (1918), *Rhagoletis pomonella*, Walsh.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro*, February 1919, pp. 15–23. [Received 21st May 1919.]

Observations on *Rhagoletis pomonella*, Walsh (apple maggot) made during 1918 are recorded, supplementing the work of previous years [see this *Review*, Ser. A, vii, p. 177]. A table shows the emergence of adult flies from out-of-door cages. The date of the first emergence was 14th July, approximately the same as in previous years, and it is evident that whether the season be early or late the time of emergence is practically the same; this fact should have an important bearing on the control of the pest.

Another table shows the emergence of adults according to the variety of fruit from which they were derived. Observations on the pre-oviposition period indicate that there is not much difference between free and captive flies in this respect. Oviposition begins in from one to two weeks after emergence and continues for about one month. Flies kept in captivity have lived as long as six weeks, though the average was much less. They survive longer in cooler weather. The foregoing data all indicate the necessity when spraying of having the fruit thoroughly coated with the poison when the flies first appear and of keeping them so covered during the period of maximum emergence.

PAYNE (H. G.). **The Salt Marsh Caterpillar (*Estigmene acraea*, Drury).**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro*, February 1919, pp. 24–31, 1 plate. [Received 21st May 1919.]

Estigmene acraea, Drury, is a moth that is widely distributed over the greater part of Canada, the United States and Mexico, and its popular name is misleading, since it attacks many crops and is by no means confined to salt marshes. In Nova Scotia, as in other parts, reports indicate that outbreaks of it are generally local in character, and rarely serious. During the last two years frequent complaints have been received from various parts of the Province of damage to all kinds of garden and field crops. Females have been found depositing large masses of eggs on potato, sunflower, apple, nasturtium, onion and many other plants. This occurs from 1st to 10th July, and the young larvae emerge about fifteen days later and feed at first on the tenderest parts and later often consume the whole leaf. After the sixth moult the caterpillars feed ravenously for a time and then scatter, generally pupating under loose bark, fences, boards of buildings, etc. The winter is passed in the pupal stage, the adult moths emerging during the early part of the following July. The stages of the insect are described. While no natural enemies have been obtained in the

course of these observations, it is hoped to secure some parasites from material now in hand. A bug, *Podisus spinosus*, Dall., has been recorded as vigorously attacking the larvae of *E. acraea*, and *Apanteles rileyanus*, Ashm., is parasitic on them. Collections of the caterpillars in the field showed that large numbers are killed by fungous and bacterial diseases.

SANDERS (G. E.) & KELSALL (A.). **A Copper Dust.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro,* February 1919, pp. 32–37. [Received 21st May 1919.]

During the summer of 1918, extensive tests were made with a dust mixture of 5 per cent. metallic copper and 2 per cent. metallic arsenic as a substitute for liquid Bordeaux spray. For these experiments, 20 lb. of crystal copper sulphate were roasted until dry and white and then ground finely enough to pass a screen of 100 meshes to the inch. This gave $12\frac{1}{2}$ lb. of white powdered de-hydrated copper sulphate, to which were added $7\frac{1}{2}$ lb. dry calcium arsenate (40 per cent. AS_2O_5) and 80 lb. hydrated lime. This mixture was thoroughly stirred and applied with a dust blower. For apples the formula was halved, making $2\frac{1}{2}$ per cent. metallic copper to 1 per cent metallic arsenic. It is hoped that this mixture may be further improved by grinding the copper more finely and by the use of a better dusting arsenate, such as is being developed for use on cotton. The results of the use of the dust on potato and apple are given and are considered to show a decided advantage over Bordeaux mixture. The dust adheres well to the foliage even when dry, and as soon as dew has fallen or if the leaves were damp at the time of application, the foliage at once has the appearance of having been drenched with Bordeaux mixture. The dust can be stored for some months without deterioration. The question of the cost of the two methods is discussed, and it is pointed out that while the completed dust mixture would probably cost about 60 per cent. more than liquid material necessary to spray the same area, the cost of application is so much less that the dust method should prove on the whole considerably less expensive.

It is not considered that this dust has yet reached the standard to be recommended to the practical grower. The formulae have yet to be worked out for use on various plants. It is unlikely that the dust can be used for the first application after blossoming on the apple because of the danger of russeting the fruit. It will probably be several years before the various formulae have been satisfactorily worked out, and their relative efficiency as compared with liquid Bordeaux mixture thoroughly tested.

WHITEHEAD (W. E.). **Notes on the Life History and Immature Stages of Three Common Chrysomelids.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro,* February 1919, pp. 38–50, 2 plates. [Received 21st May 1919.]

Larvae of *Disonycha quinquevittata*, Say, were reared from golden rod (*Solidago squarrosa*), which is apparently their exclusive food.

Chrysomela scalaris, Lec., was abundant during the summer of 1918 and eggs brought into the laboratory were reared to maturity. While the beetles have been recorded from other localities on alder (*Alnus glutinosa*), basswood, elm, linden and willow, during the present observations in Nova Scotia they were found only on alder.

Gastroidea polygoni, L., was reared from eggs taken on wild buckwheat (*Polygonum convolvulus*) during early August.

Descriptions are given of the various stages of these beetles and their life-histories are summarised in tables.

SANDERS (G. E.) & BRITTAIN (W. H.). **A Modified Bordeaux Mixture for Use in Apple Spraying.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro*, February 1919, pp. 51–61.

The literature dealing with the question of the correct proportion of lime to use in the manufacture of Bordeaux mixture is briefly reviewed; the principal changes that have been made in the formulae employed are discussed and the reasons for these explained. While further experiments are considered necessary to elucidate certain points, the authors draw attention to the value of Bordeaux mixture formulae with a much higher excess of lime than have ordinarily been employed in apple spraying, and offer the following provisional conclusions, which they believe to be correct for Nova Scotia conditions, at least during the period studied by them.

Neutral Bordeaux mixtures, such as Woburn Bordeaux, are not superior as fungicides under actual field conditions to ordinary Bordeaux made with equal parts of lime and copper sulphate, and such neutral Bordeaux causes very much more injury to apple foliage. Bordeaux mixture made up to the formula of 3-10-40 or 2-10-40 has a higher fungicidal value than sulphide sprays in safe dilutions. Leaf yellowing and other Bordeaux leaf-injury is reduced to a minimum, if not entirely eliminated, by the use of such formulae. The benefits in the form of freedom from injury produced by excess of lime, apparently cease at about five parts of lime to one of copper sulphate. For all practical purposes, fruit russeting, in the varieties tested, is eliminated by substituting a spray of sodium polysulphide for the application immediately following the dropping of the blossom petals in carrying out the regular orchard spraying programme. As a "carrier" for arsenicals, Bordeaux mixtures containing a high excess of lime, such as 2–10–40 and 3–10–40 formulae, render all arsenical poisons tested remarkably safe for use on foliage, but on the other hand, they render them very low in killing value. Not less than 1 lb. to 40 gals. of calcium-arsenate, analysing from 40–44 per cent AS_2O_5, should therefore be used in these mixtures. During the period it has been under observation, excess lime Bordeaux of either the 3–10–40 or 2–10–40 formula has given, on the whole, better results with less injury than the mixtures commonly in use. In Nova Scotia and New Brunswick it is growing rapidly in favour, and many growers will use it in future for three sprays, and many more for at least the fourth spray. Fruit sprayed entirely with this compound, does not have the smooth waxy finish obtained from the use of sulphide sprays.

BRITTAIN (W. H.) & PAYNE (H. G.). **Some Notes on *Olene vagans*, B. & McD., in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro*, February 1919, pp. 62–68, 1 plate. [Received 21st May 1919.]

In June 1917, a number of caterpillars of the genus *Olene* were collected beneath tanglefoot bands in orchards and were reared to maturity. Dr. J. McDunnough, to whom larvae and adult moths were sent for identification, believes them to be *O. vagans*. The caterpillars were found only on apple in Nova Scotia, though they have previously been recorded on beech and poplar. Particulars of the life-history are shown in a table and the various stages are described. The only parasite discovered during these laboratory investigations was *Tachina mella*, Wlk. It is thought that further observations in the field will reveal other natural enemies, especially as the scarcity of the moths indicates the probability of their being held in check by parasitic or predaceous foes.

SANDERS (G. E.) & KELSALL (A.). **Some Miscellaneous Observations on the Origin and Present Use of some Insecticides and Fungicides.** —*Proc. Entom. Soc. Nova Scotia for 1918, Truro*, February 1919, pp. 69–75. [Received 21st May 1919.]

The chief insecticides and fungicides at present in use are dealt with in this paper, namely, Paris green, lead arsenate, calcium arsenate sodium arsenate, sodium arsenite, white arsenic, Bordeaux mixture-lime-sulphur and sodium sulphide. The history of their adoption in entomological work and the characteristic advantages of each are discussed. It is remarked that in Nova Scotia calcium arsenate is probably used proportionately more than in any other place. In orchards it is being used with Bordeaux mixture and sulphide sprays almost to the exclusion of other insecticides, and to some extent also on potatoes. Paris green has been largely replaced by cheaper or safer arsenicals. Lead arsenate is used for cankerworms and for sporadic outbreaks of such insects as the tussock caterpillar [*Hemerocampa*]. Sodium arsenate is but little used, being no cheaper than the calcium arsenate which is preferred. White arsenic is scarcely used at all, though it may possibly prove of value in a modified Bordeaux mixture. The latter is used with equal parts of copper sulphate and lime on potatoes. For apples, a mixture of three to five times as much lime as copper sulphate is in general use in orchards. This controls fungi well, and is the least injurious mixture for apple foliage. Lime-sulphur, which is used as a dormant spray wherever San José scale [*Aspidiotus perniciosus*] is prevalent, was largely used for some years in Nova Scotia as a light summer spray, but when the coarser driving sprays became general, it was found to cause considerable leaf injury when applied in that form, and is now being rapidly replaced by Bordeaux mixture containing lime in excess. Sodium sulphide is more used in Nova Scotia as a summer spray than in most orchard districts. It is found to produce less injury, and almost the same fungus control, as lime-sulphur, and is becoming increasingly used as the spray immediately following the blossoms, replacing for this particular spray the excess lime Bordeaux mixture.

BRITTAIN (W. H.). **Notes on *Lygus campestris*, L., in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro,* February 1919, pp. 76–81, 1 plate. [Received 21st May 1919.]

Lygus campestris, L., is widely distributed in North America, and is common in Nova Scotia. It has been recorded from Europe and America on Umbelliferae, and in New York on the poison hemlock (*Conium maculatum*). At Truro, Nova Scotia, it has been found on wild parsnip (*Heracleum lanatum*) and the cultivated parsnip (*Pastinaca sativa*). The adults first appear in late June and throughout July, and oviposition begins about a week after emergence, the eggs generally being laid in the grooves of the small stalks bearing the flower-heads. Hatching occurs within a few days and the nymphal stage lasts between four and five weeks, during which five moults occur. The adults, after a short period of activity, seek a suitable shelter for winter quarters, where they remain until the following spring. Details of the life-history are given in a table and the various stages are described.

The injury to the plant is of two kinds, the oviposition punctures on the small stalks bearing the umbels causing the flower-heads to droop, and secondly there is the damage resulting from the feeding punctures of both adults and nymphs, both on the flower-heads and on various other parts of the plant, including the leaf-petioles. In several cases the death of the plants may be caused in this way. While the insect is capable of doing considerable damage under certain conditions, it is evident from the scant attention that has been paid to it in the literature of economic entomology that this rarely occurs. The best remedy is a strong spray of Black-leaf 40, 1 pint to 100 gals., to which 4 lb. of soap have been added. This should be applied soon after the insects hatch and with as high a pressure as possible.

PAYNE (H. G.). **Life History and Immature Stages of *Abbotana clemataria*, Smith & Abbot.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro,* February 1919, pp. 82–85, 1 plate. [Received 21st May 1919.]

The Geometrid moth, *Abbotana clemataria*, S. & A., is recorded on apple and elm in Nova Scotia. Descriptions of the various stages are given and the life-history is summarised in a table.

ALLEN (E. C.). **Key for determining the Crambinae of Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro,* February 1919, pp. 86–88, 1 plate. [Received 21st May 1919.]

The contents of this paper are indicated by its title.

BRITTAIN (W. H.). **A Tree Hopper new to our List.**—*Proc. Entom. Soc. Nova Scotia for 1918, Truro,* February 1919, p. 89. [Received 21st May 1919.]

Another species is added to the MEMBRACIDAE of Nova Scotia previously recorded [see this *Review*, Ser. A, vii, p. 177]. This is *Enchenopa binotata*, Say, found on climbing bittersweet, locust and butternut; on the first-named plants eggs are deposited in the stems and covered with a frothy secretion; on butternut they are laid in the buds and are not covered with froth.

MORRISON (H.). U.S. Bur. Entom. **A Report on a Collection of Coccidae from Argentina, with Descriptions of apparently New Species (Hom.).**—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 4, April 1919, pp. 63–91, 4 plates.

The new Coccids described include *Icerya minima*; *Eriococcus mendozae*; *E. leguminicola* on *Mimosa*, *Caesalpinia* and other Leguminosae; *E. jorgenseni* on *Myricia apiculata*; *Ceroplastes deciduosus* on *Lapium biglandulosum*; *Ceroplastodes misiones* probably on a Composite; and *Saissetia argentina*.

Notes on some previously described species are also given, with a key to the South American species of *Eriococcus*.

FISHER (W. S.). U.S. Bur. Entom. **Descriptions of a new Genus and Species of Buprestidae from Arizona (Col.).**—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 4, April 1919, pp. 91–93.

A key is given to the North American genera of Buprestids that are comprised in the group ACMAEODERINI. *Paratyndaris coursetiae*, gen. et sp. n., reared from pupae collected in June from dead stems of *Coursetia microphylla* is described.

BAKER (A. C.). U.S. Bur. Entom. **An Undescribed Species of *Dryopea* injurious to *Phyllostachys* (Aphididae—Hom.).**—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 5, May 1919, pp. 104–106, 1 fig.

Dryopea morrisoni, sp. n., is described from *Phyllostachys* in pots, where it was detected on the roots by means of the white wax secreted. Only apterous forms were taken; these had the appearance of stem-mothers, but no eggs were obtained and all reared individuals of the next generation proved to be winged.

CUSHMAN (R. A.). **New Genera and Species of Ichneumon Flies (Hym.).**—*Proc. Entom. Soc. Washington*, xxi, no. 5, May 1919, pp. 112–120, 1 fig.

Descriptions are given of three new genera, three new species and a new variety of Ichneumonids and one new Braconid: these include *Labrossyta ruficoxalis*, sp. n., a parasite of the spruce sawfly [*Diprion abietis*] in Manitoba; *Hyposoter fugitivus* var. *pacificus*, n., from Washington, parasitising *Malacosoma pluvialis* and *M. ambisimilis*; and *Apanteles iselyi*, sp. n., a parasite of *Canarsia hammondi*, Riley, in Arkansas.

BUSCK (A.). **A New Species of *Bucculatrix* injurious to Hollyhock (Lep.).**—*Proc. Entom. Soc. Washington*, xxi, no. 5, May 1919, pp. 109–110.

Bucculatrix althaeae, sp. n., is described from California, where it is doing considerable damage to hollyhocks by skeletonising the leaves. As hollyhock is not a native plant, the normal food-plant of this moth will probably prove to be some other Malvaceous plant.

Orchard Pests and Diseases: Directions for Control.—*N.Z. Jl. Agric., Wellington*, xviii, no. 3, 20th March 1919, pp. 182–185.

This paper, which is to be issued in the form of a bulletin, contains directions and formulae for spraying for the commoner pests of orchards. A reference table is given standardising home-made lime-sulphur solution based on a 33° Bé. standard.

Ross (W. A.). **Occurrence of the Pear Thrips in Ontario.**—*Canadian Entomologist, London, Ont.*, li, no. 4, April 1919, p. 85.

Taeniothrips inconsequens, Uzel (pear thrips) was taken by the author in the spring of 1918 on pear trees in Ontario, this being the first record of its occurrence in that Province. It was present in small numbers and was not causing any appreciable injury.

Weiss (H. B.) & Nicolay (A. S.). **Notes on the Life-History and Early Stages of *Brachys ovatus*, Web., and *Brachys aerosus*, Melsh.**—*Canadian Entomologist, London, Ont.*, li, no. 4, April 1919, pp. 86–88, 2 plates.

Former records of the Buprestid beetles, *Brachys ovatus* and *B. aerosus*, in the United States are briefly referred to. In New Jersey adults of *B. ovatus* have been observed feeding on the foliage of elm (*Ulmus americana*), sugar maple (*Acer saccharum*), white oak (*Quercus alba*), chestnut oak (*Q. prinus*), pin oak (*Q. palustris*), chestnut (*Castanea dentata*), scrub oak (*Q. ilicifolia*), black oak (*Q. velutina*), post oak (*Q. minor*), beech (*Fagus ferruginea*) and hickory (*Hicoria glabra*), the various species of oaks being the preferred food-plants; *B. aerosus* occurs on beech (*F. ferruginea*), linden (*Tilia americana*), witch hazel (*Hamamelis virginiana*), elm, chestnut, sugar maple, red maple (*A. rubrum*) and several species of oaks. The adult beetles of both species feed on the upper leaf-surfaces, usually near the edges, consuming the tissue between the larger veins; the remaining tissue generally withers away, leaving large, irregular holes. The life-histories are very similiar. Adults appear about mid-May, are most plentiful during June and early July, and disappear early in August. The eggs are laid on the upper surface of the leaves, generally near the edges. The larvae mine the leaves during August and September, generally only one larvae being found in a mine, those of *B. ovatus* being much longer than those of *B. aerosus*. Not all the food-plants chosen by the adults are mined by the larvae, oaks being decidedly preferred for the purpose. Pupation generally occurs in October, probably on the surface of the soil, in rubbish, or just under the ground surface, and in this stage the winter is passed.

Practically all the eggs of *B. ovatus* in cages and many in the field, as well as many of the larvae that started mines, were parasited by a Chalcid, *Closterocerus cinctipennis*, Ashm.

Hathaway (J. E.). **Nut Weevil.**—*Gardeners' Chronicle, London*, lxv, no. 1691, 24th May 1919, p. 253.

The nut weevil [*Balaninus nucum*] is often allowed to increase through neglect, but may be kept in check by clean cultivation, and where possible, spraying the trees with an insecticide. The female

oviposits in the young nuts, in most localities in May, and crawls along the shoots to do this. A good dressing of soot and lime applied to the soil before the female climbs the tree acts as a deterrent. The eggs hatch in about a fortnight, and the larvae feed on the young nut, but without destroying its vitality until they are fully grown. The larva eats its way out of the nut at the end of the season. The most effective measure consists in shaking the trees well in August, when the fallen infested nuts should be gathered and burnt. If this precaution is carried out each season, the trees will soon be rid of the pest.

RAO (Y. R.). **Notes on some South Indian Cecidomyiids causing Galls in Grasses.**—*Jl. & Proc. Asiatic Soc. Bengal, Calcutta*, xiii, no. 5, December 1917, pp. 299-306, 1 plate. [Received 26th May 1919.]

Rice is subject to a disease known as "Silver-shoots," which is characterised by the development of a long hollow shoot instead of the normal ear-head. This is caused by a Cecidomyid, *Pachydiplosis oryzae*, which oviposits on the plant, the larvae causing the formation of the tube-like gall inside which they pupate. The pupal stage lasts about six days, and the adult flies emerge through a hole bored at the tip. Galls have been examined and flies reared from the following grasses in the attempt to find the wild food-plant of *P. oryzae*:—*Panicum fluitans*, *P. punctatum*, *P. stagninum*, *Ischaemum ciliare*, *I. pilosum*, *Andropogon annulatus*. The flies bred out, except in the case of *P. stagninum*, however proved to be distinct species, each restricted to a single grass.

Numerous parasites attack these gall-insects and fall into two groups, Chalcids that oviposit on or near the larvae of the host, and Proctotrupids, that hunt for and oviposit in the eggs of the host, e.g., *Platyogaster oryzae*.

SANDERS (G. E.) & DUSTAN (A. G.). **The Apple Bud Moths and their Control in Nova Scotia.**—*Canada Dept. Agric. Entom. Branch, Ottawa*, Bull. no. 16 (Technical Edition), 1st March 1919, 39 pp., 14 figs.

The species of bud-moth destructive to the apple that have been found in Nova Scotia are *Eucosma* (*Tmetocera*) *ocellana*, Schiff. (eye-spotted bud moth), the most important from an economic standpoint [see this *Review*, Ser. A, iii, p. 258, etc.]; *Tortrix* (*Cacoecia*) *rosaceana*, Harr. (oblique-banded leaf roller), which has a large number of native food-plants but does a small amount of injury to apple trees almost every year; *Recurvaria nanella*, Hb. (lesser bud-moth), of European origin and of comparatively recent introduction into North America; *Argyroploce consanguinana*, Wlsm. (green bud-worm), only regarded as of economic importance since 1913. All four species fly during June and July and oviposit on the leaves of apple, their life-histories and the injuries inflicted by them being similar. They hibernate as partly grown larvae under bark or in crevices about the fruit spurs. In the spring the larvae emerge and eat into the opening buds, thus affecting the set of the fruit.

It is estimated that these bud-moths reduce the crop by about 30 per cent. in unsprayed or poorly sprayed apple orchards in Nova Scotia. About 75 per cent. of the insects can be destroyed and the crops increased about 22·5 per cent. by two thorough applications of poisoned spray applied before the blossoms open, with a nozzle throwing a coarse driving spray. Open planting and thorough pruning help in the control by allowing the wind to blow away and destroy many of the adults when they are on the wing in June and July. Damage to fruit is caused in the autumn by the larvae attaching the leaf on which it is feeding to the fruit, eating through the skin and injuring its appearance and keeping qualities. A spray that has proved one of the best combinations tested, and particularly harmless to foliage when applied as a drenching spray, is composed of sodium sulphide (either soluble sulphur $2\frac{1}{2}$ lb. or sulfocide $2\frac{1}{2}$ quarts) and calcium arsenate $1\frac{1}{4}$ lb. with freshly slaked stone lime or hydrated lime 12 lb. to 100 gals. water. This combination is one of the cheapest and most effective for biting insects. Probably one of the most satisfactory sprays in the control of serious infestations is straight paste lead arsenate, 10 to 15 lb. to 100 gals. water, to which from 5 to 10 lb. water-slaked or hydrated lime has been added to prevent yellowing by absorbing the free arsenic. At these strengths lead arsenate is as good a fungicide as lime-sulphur. A contact-spray consisting of soluble sulphur 2lb., nicotine sulphate 1 pint, fish oil soap 4 lb. and water 100 gals., applied as a drenching spray immediately before the blossoms has given almost perfect control of bud-moths as well as canker-worms, fruit worms and many other Lepidopterous larvae.

Recorded parasites of *E. ocellana* include:—*Microdus ocellanae*, Rich., *M. laticinctus*, Cr., *Anomalon* sp., *Chelonus* sp., *Trichogramma (Pentarthron) minutum*, Riley, *Phytodietus vulgaris*, Cr., *Pimpla* sp., near *P. alboricta*, Cr., *Pimpla conquisitor*, Say, and *Microdus (Bassus) earinoides*, Cr.

Pimpla alboricta, Cr., *Meteorus communis*, Cr., and three other species of undetermined Hymenopterous parasites have been reared from *O. consanguinana*.

BODKIN (G. E.). **Report of the Economic Biologist.**—*Brit. Guiana Dept. Sci. & Agric., Rept. for the Year 1917, Georgetown*, 8th May 1918, 14 pp. [Received 24th May 1919.]

In spite of the continued application of the usual remedial measures sugar-cane pests did not show any decrease in the year under review.

Rubber (*Hevea brasiliensis*) suffered chiefly from attacks of the Venezuelan locust.

Brassolis sophorae, L., made its appearance on coconuts, but owing to timely warnings a repetition of the outbreak of this butterfly in 1913–14 was prevented, although several areas had to be quarantined. Other coconut pests reported were the moth, *Castnia licus*, Drury, the giant locust, *Tropidacris latreillei*, Perty, and the Venezuelan locust.

The only infestation of *Citrus* trees of importance was that by *Atta cephalotes*, L. Details of the destruction of this ant by means of carbon bisulphide are given.

The Coccid, *Coccus* (*Lecanium*) *viridis*, Green, was the principal pest of coffee and cacao, and was attended by various species of ants. A few cases of attack by termites were recorded. An account is also given of the locust invasion [see *Review*, Ser. A, vi, p. 335].

The new and other COCCIDAE of British Guiana mentioned in this report have been previously dealt with [see this *Review*, Ser. A, v, p. 563].

KNOWLES (C. H.). **Division of Entomology.**—*Fiji Dept. Agric., Ann. Rept. for Year 1917, Suva*, Council Paper no. 60, 16th August 1918, pp. 8–12. [Received 27th May, 1919.]

Cosmopolites sordidus (banana borer) was prevalent in all banana districts during the year, doing considerable damage in many localities. More than half the damage done by the larvae is situated in the outer edge of the bulb, and since this is the zone within which many of the fibro-vascular bundles that convey nourishment to the growing parts of the plant are localised, it is clear that the damage done is more than the mere removal of a certain amount of the plant-tissue, while the injuries also encourage the growth of fungous and bacterial diseases. Trapping with pieces of split banana stems or bulbs is advised as a means of reducing the number of weevils, but proper cultivation as a means of preventing breeding of the insects is still more important. A weevil similar to *C. sordidus* but smaller has again been found attacking bananas, chiefly the outer leaf-stalks. The amount of damage is not yet precisely known. COCCIDAE have been found in all banana districts, the most common being *Aspidiotus destructor* (*transparens*). Spraying with lime-sulphur or kerosene emulsion is carried out on well-kept estates, and an addition has recently been made to the Regulations under the Diseases of Plants Ordinance requiring cultivators of plants attacked by or liable to be attacked by the declared diseases to keep their plantations in a suitable state of cultivation, and this greatly increases the effectiveness of the spraying. Mites have caused some damage to banana leaves when present in great numbers. The caterpillars of the banana scab moth [*Nacoleia octosema*] which attack the very young fruit are still plentiful, their attacks being kept down by dusting the young bunches with pyrethrum powder or the ground leaves of a native plant at as early a stage as possible.

On coconuts, *Levuana iridescens* (coconut leaf moth) was present, and generally occurs in more than one stage throughout the year. This pest appears to be spreading westward along the north coast of the island. A bug, *Canthecona cyanocantha*, preys upon these caterpillars. The infestation varies considerably in different blocks. In some trees of considerable age the tops gradually grow smaller and at last die and fall off, no insect other than *L. iridescens* being found on the trees.

Trachycentra calamias, Meyr. (leaf-stalk borer) was found only in one locality boring into the bases of coconut leaf stalks. A stick insect, *Lopaphus cocophagus*, New., defoliated some of the trees in one plantation. These insects are controlled to a certain extent by birds. The best method of dealing with them is to make smudge fires, which stupify them and cause them to fall from the trees, when they can be collected and destroyed. The Hispid beetle, *Promecotheca reichii*

(coconut leaf-miner), has been effectively kept in check during the year by its Chalcid parasite. A Pyralid moth, *Harpagoneura complena*, was active in several places and was the cause of the destruction of many young nuts.

Adoretus tenuimaculatus (Japanese rose beetle) considerably damages cacao leaves in newly planted areas. The remedy is to surround the plants with a fence of split bamboo battens about an inch apart. A Scoliid wasp has been introduced from Hawaii to destroy the larvae of this beetle.

On rubber, a bark-boring beetle was found in two districts, but is not of much importance. Scale-insects were nowhere very abundant. A leaf-miner was found on the leaves, but the damage was not serious; many larvae found dead within their mines seemed to have been killed by some parasite.

Phytomyza sp. (leaf-miner) attacked maize in several localities, the larvae eating away the cells immediately beneath the upper epidermis of the leaves in a more or less straight track; owing to the unusual scarcity of two Chalcid parasites this pest was able to do considerable damage.

On *Citrus*, *Chionaspis citri* (orange snow scale) is present without causing much injury.

Potatoes were grown on an unusually large scale during the year. An unidentified Lepidopterous larva bored into the stems of full-grown plants, causing the upper portion to wilt. The mature larva pupates in the ground near the base of the plant. *Epilachna vigintioctopunctata* (potato ladybird) was numerous, both larvae and adults feeding on the leaves. If necessary, dusting with Paris green or spraying with lead arsenate will control this Coccinellid beetle.

On ornamental plants, a mite, *Eriophyes hibisci*, has been numerous during the year, and it is suggested that hedges of *Hibiscus* should be trimmed at a time when the attack of the mites is most pronounced.

The lantana fly (*Agromyza* sp.), introduced from Hawaii in 1911, continues to check the increase of this weed. The larva of a butterfly, *Anosia* sp., feeds upon milk-weed (*Asclepias* sp.), which is regarded as poisonous to stock.

LEGISLATION.

Amendments to the Regulations under the Destructive Insect and Pest Act.—Leaflet from *Canada Dept. Agric., Ottawa, Entomological Branch.* [Received 24th June 1919.]

By an Order-in-Council passed 19th May 1919, the importation into Canada is prohibited of all maize fodder or maize stalks, whether used for packing or otherwise, green sweet maize, roasting ears, maize on the cob or maize cobs from certain counties of the States of Massachusetts and New York. This prohibition does not extend to shipments of maize transported through the quarantined areas on a through bill of lading. To Section 18 of the Act, which contains a list of the destructive insect pests and diseases, *Pyrausta nubilalis*, Hbn. (European corn borer) is added.

SANDERS (G. E.) & DUSTAN (A. G.). The Fruit Worms of the Apple in Nova Scotia.—*Canada Dept. Agric. Entom. Branch, Ottawa*, Bull. no. 17 (Technical Edition), 1st March 1919, 28 pp., 9 figs.

The species of fruit-worms attacking the apple in Nova Scotia and dealt with in this bulletin are:—*Graptolitha bethunei*, G. & R., *G. laticinerea*, Grt., *G. antennata*, Wlk., *G. georgii*, Grt., *G. baileyi*, Grt., *Conistra walkeri*, Grt., *Xylina nupera*, Lint., *X. cineritia*, Grt., and *X. curvimacula*, Morr. [see also this *Review*, Ser. A, iv, pp. 120, 371].

Control measures against these moths by thorough cultivation during July and August, though recommended by several writers, has never been proved to be of value in destroying the pupae. In spraying, since the effect is largely mechanical, the pre-blossom spray should be applied at a high velocity in serious outbreaks, and as near the time of blossoming as possible. Drenching sprays should not be applied immediately before and after blossoming on account of mechanical injury to the blossoms. Efficient control may be exercised by the application of two sprays, the pre-blossom and another immediately after the blossoms fall, which in severe outbreaks may have to be a drenching or driving spray. For this latter the best combination is:—lead arsenate, 10 to 15 lb. to 100 gals. water, to which 10 lb. hydrated or water-slaked lime is added to prevent yellowing of the foliage.

Meteorus communis, Cr., has been bred from the larva of *Graptolitha bethunei* and *Trichogramma* (*Pentarthron*) *minutum* from the egg, but the latter parasite is never abundant enough to effect control.

PARROTT (P. J.). The Spray Gun: Its Use and Abuse.—*Canadian Horticulturist, Toronto*, xlii, no. 5, May 1919, p. 136.

Attention is drawn to the fact that though the introduction of the spray-gun has marked an epoch in the development of spraying and is an undoubted economy in time, labour and materials, a tendency is shown to exaggerate its importance and to undervalue the teaching of long-established spraying practices. In particular, the question of safety to fruit and foliage should be considered. The volume of liquid discharged from a spray-gun under high pressure is large and it is an easy matter to over-spray certain portions of a tree. Care should be taken to direct the spray as a fine mist and from all angles. Spraying should be done on days when the material will dry quickly on the foliage and the approved spraying schedule should be followed. Applications of lime-sulphur and lead arsenate should not be made during periods of high temperature.

SWEZEY (O. H.). Notes on the Chinese Dryinid Parasite of the Sugarcane Leafhopper.—*Hawaiian Planters' Record* [*sine loco*], xx, no. 4, April 1919, pp. 239–242, 3 figs.

Pseudogonatopus hospes, the large black Dryinid parasite of the sugarcane leaf-hopper [*Perkinsiella saccharicida*] was discovered in Canton, China, in 1906. Colonies were liberated in Hawaii in 1907, but it was not till 1916 that any of them were seen, being so scarce in the meantime

that none happened to be observed. Usually not more than about 1 per cent. of the adult leaf-hoppers are found to be parasitised, and when cocoons of the parasite are collected in the field, hyperparasites issue from a large proportion of them, thus reducing the efficiency of the parasite. This Dryinid attacks the adult leaf-hoppers, immature individuals being only rarely parasitised by it; in this respect it differs from *Echthrodelphax fairchildi* and *Haplogonatopus vitiensis*, both of which attack the young leaf-hoppers and only rarely an adult. The egg is inserted in the dorsal part of the abdomen. The leaf-hopper dies when the parasite becomes full-grown, and the latter spins a cocoon on a leaf or on the sugar-cane stalk itself, about 3 or 4 weeks being spent in this stage; the whole life-cycle occupies 4 to 6 weeks. In the laboratory a female Dryinid lived 37 days and parasitised 153 leaf-hoppers, showing how great would be its value if it were not hyperparasitised.

JACK (R. W.). **Maize Culture on Red Soil: Value of Poisoned Bait as an Aid to good Stands.**—*Rhodesia Agric. Jl., Salisbury*, xvi, no. 2, April 1919, pp. 107–112, 1 fig. Also issued as *Rhodesia Dept. Agric., Salisbury*, Bull. no. 317, April 1919, 8 pp., 1 fig.

It is estimated that the average stand of vigorous maize plants on red soil in Rhodesia is 60 to 70 per cent., the greater part of the destruction of the remainder being due to insect pests. The soil within a few inches of the surface supports a good deal of insect life in an immature condition during the dry season, and the adults, many of which are plant-feeders, emerge just about the commencement of the rains. As soon as the plants begin to appear they are attacked eagerly by these insects, the seed, the shoot before it reaches the surface, or the young plant, all being liable to attack. The insects that affect the stand of maize, apart from those that attack the plant after it has become established, such as maize stalk borer [*Busseola fusca*], include two species of surface beetles, *Gonocephalum aequale* and *Emyon tristis*. The eggs of these beetles are laid loosely in the soil from late March throughout the dry season and in greatly reduced numbers after July. The larvae feed upon dry vegetable matter in the soil, but will eat into dry seeds if these are available. The majority have completed their growth by November and pupate in the soil, the adults emerging in two or three weeks. The adults live until late March before beginning oviposition, and in this stage only are destructive to the maize crop. Two species of weevils occur, namely *Systates* sp. and *Tanymecus* sp. The life-histories of these are not accurately known, but the larvae seem to live in the soil and feed upon the roots of certain weeds or native plants. The adults are active in late November and are often present about the soil before the crop is planted. Field crickets, grasshoppers, cutworms and wireworms (*Trachynotus* sp.) are also injurious to the stand of maize. None of these insects are specific maize pests, but with the exception of grasshoppers and possibly crickets, they seem to flourish better under conditions of cultivation than under natural ones. This is due to the greater looseness or penetrability of cultivated soils and the fact that cultivation encourages the growth of weeds other than grasses.

The effect of the activities of these insects on the maize plants is discussed.

The greater part of the loss may be avoided at comparatively little cost by the use of a poisoned bait consisting of 1 lb. sodium arsenite or Paris green, 8 lb. crude sugar or 2 lb. molasses, to 10 gals. water. A quantity of green vegetation should be chopped up finely, dipped in the liquid, drained and distributed broadcast over the soil, particularly towards evening, as most of the insects feed at night. The larvae of wireworms are not, however, attracted by this bait, but the adult beetles have been poisoned by it under favourable conditions. The bait should be applied just before the appearance of the crop above ground, though the weather must be taken into consideration, a favourable time being an interlude after the first heavy showers have fallen. There is also some benefit from baits laid any time between December and the beginning of March, though the beetles at this time are sheltering within the plants. It must not be expected that a single application of bait will rid the land of these pests, and it must be remembered that it is no remedy for such enemies as *Busseola fusca* or *Heteronychus mashunus* (maize beetle).

BENTLEY (G. M.). **Pruning and Spraying the Home Orchard and Vineyard.**—*Tennessee State Bd. Entom., Knoxville,* Bull. no. 27 (vii, no. 4), December 1918, 31 pp., 49 figs. [Received 21st May 1919.]

This profusely illustrated bulletin has been prepared for the guidance of prospective fruit-growers, and deals with pruning methods and implements, spray tables for apples, peaches and plums, formulae for the usual spray solutions, and descriptions of the most modern spraying appliances.

COOLEY (R. A.). **16th Annual Report of the State Entomologist of Montana.**—*Univ. Montana Agric. Expt. Sta., Bozeman,* Bull. no. 126, December 1918, pp. 23–44. [Received 21st May 1919.]

A list is given of the commoner insect pests of 1918. Grasshoppers were less numerous than in the previous year, and were kept in check to a great extent by parasitic flies, *Sarcophaga* spp., and the energetic efforts of the farmers. Those recorded include *Camnula pellucida*, Scud., *Melanoplus bivittatus*, Say (two-striped locust) and *Aulocara elliotti*, Thom. (big-headed grasshopper).

Cutworms were very abundant during the year, especially *Euxoa ochrogaster*, Gn., a species that cuts the plants off below the surface.

Extensive damage was caused to the stems of young winter wheat by a maggot found in May and subsequently identified as *Hylemyia cerealis*, Gillette.

Loxostege sticticalis, L. (sugar-beet web-worm) caused great anxiety owing to its presence in vast numbers, but no great damage was done in spite of the fact that it is a very general feeder.

The bug, *Nysius ericae*, Schill., was mainly injurious to garden plants.

Details are given of the quarantine measures in force with regard to *Hypera variabilis* (*Phytonomus posticus*) (alfalfa weevil).

SEVERIN (H. C.). **The Buffalo Tree Hopper, the Plum Tree Borer, the Leaf Crumpler, the Plum Web-Spinning Sawfly, the Mealy and Rusty Brown Plum Lice, the Plum Curculio and the Plum Gouger, and Scale Insects.**—*Office of State Entomologist S. Dakota, Brookings,* Circulars 2–8, November 1918. [Received 28th May 1919.]

The bulk of the information contained in these circulars has already been noticed [see this *Review*, Ser. A. vii, p. 183.]. *Chionaspis salicis-nigrae*, Walsh (poplar and willow scale) is one of the principal insect pests of these trees in South Dakota, whether growing wild, or in parks, streets, etc. When the insects are very abundant the tree may be dwarfed or even killed. Remedial measures are the same as for the oyster-shell scale [*Lepidosaphes ulmi*].

EWING (H. E.). **New Acarina. Part II.—Descriptions of New Species and Varieties from Iowa, Missouri, Illinois, Indiana and Ohio.**—*Bull. Amer. Museum Nat. Hist., New York,* xxxvii, 1917, pp. 149–168, 4 plates. [Received 18th June 1919.]

Among the mites dealt with in this paper is *Eupalus parvus*, sp. n., a natural enemy of *Lepidosaphes ulmi*, L. (oyster-shell scale), from which it was taken at Ames, Iowa, in which locality, however, it is not very numerous.

ELWYN (A.). **Effect of Humidity on Pupal Duration and on Pupal Mortality of** ***Drosophila ampelophila*****, Loew.**—*Bull. Amer. Museum Nat. Hist., New York,* xxxvii, 1917, pp. 347–353. [Received 18th June 1919.]

The author's summary of this paper is as follows :—Changes in relative humidity have no marked effect on the length of pupal period of *Drosophila ampelophila*. Changes in relative humidity produced striking changes in the mortality of *Drosophila*, the mortality increasing with a decrease of humidity and the optimum humidity being 100 per cent. The effects of low humidity on mortality are most marked with very young pupae, whose covering permits a rapid evaporation of body moisture. After a few hours, when integumental changes making evaporation more difficult have set in, the effects of low humidity are correspondingly decreased.

SHULL (A. F.). **Genetic Relations of the Winged and Wingless Forms to each other and to the Sexes in the Aphid,** ***Macrosiphum solanifolii.***—*American Naturalist, Lancaster, Pa.,* lii, nos. 622–623, October–November 1918, pp. 507–520.

Of *Macrosiphum solanifolii* there are four kinds of individuals, the apterous viviparous female, which is green ; the alate viviparous female, also green ; the oviparous wingless female, which is yellowish green till late in life ; and the male, which is winged and of a brown or brown and green colour, but pink or grey at birth.

Experiments have shown that winged viviparous females produce mostly wingless females in the parthenogenetic portion of the cycle, and sexual females in the sexual portion, whereas the wingless viviparous females produce chiefly winged females in the parthenogenetic

phase and males in the sexual. Thus there is a transition from a preponderance of apterous females early in the cycle to a preponderance of winged females later, and in the sexual part of the cycle, a transition from males to sexual females, these transitions implying a gradual change of some sort, probably in the metabolism of the insects.

It may be that the metabolic change that causes the transition from wingless to winged females is different from that causing the transition from males to sexual females, and these may be more or less independent of each other, and capable of being separated experimentally.

YOTHERS (W. W.). **The Mixing of Oil Emulsions with Lime-sulphur Solutions.**—*Florida Grower*, xviii, no. 18, 1918, p. 4. (Abstract in *U.S. Dept. Agric. Expt. Sta. Record, Washington, D.C.*, xl, no. 5, April 1919, pp. 454–455.)

The use of oil emulsions mixed with lime-sulphur solution [see this *Review*, Ser. A, vi, p. 449] is reported on.

In following the directions given it was found that a granular scum was formed when the glue and miscible oil combination was added to the lime-sulphur solution, and though on stirring a fairly good mixture was formed, the use of an agitator was necessary when applying it, in order to prevent the scum settling to the bottom and forming a concentrated solution that is injurious.

The results of spraying tests indicate that glue must be added to the oil emulsion when it is being made, whereas it can be added afterwards to a miscible oil. With a view to determining the effect upon whitefly [*Aleurodes*] and purple scale [*Lepidosaphes beckii*], experiments were made in which miscible oil was stabilised with (i) glue solution and (ii) milk powder. A stabilised emulsion was also used in place of the miscible oil, and the glue solution was used for a binder. It was found later that the addition of glue to a stabilised emulsion was unnecessary. Whitefly pupae were killed perfectly, and the sooty mould was loosened and fell off after the first rain. At the time of writing the sprayed trees were free from sooty mould and purple scale and had a much better appearance than a control row of unsprayed trees in the same grove. It is pointed out that while the mixture seems to be satisfactory as an insecticide, it may injure the trees and fruit.

There is no evidence to show that the combination of oil emulsions and lime-sulphur is superior to a combination of the emulsion and soda-sulphur solutions. Until further knowledge has been obtained, it would therefore be well to try the former combination experimentally only.

SMITH (R. E.). **Walnut Worm threatens Industry.**—*Cal. Cult.* li, no. 18, 1918, pp. 441, 442, 447, 6 figs. (Abstract in *U.S. Dept. Agric. Expt. Sta. Record, Washington, D.C.*, xl, no. 5, April 1919, pp. 456–457.)

The author calls attention to the fact that a biological variety of the codling moth [*Cydia pomonella*] is seriously injuring walnuts in certain parts of California, and that the immediate inauguration of remedial

measures is necessary to keep it from spreading all over the southern part of the State. In some orchards where it has been present for several years, fully 50 per cent. of the crop is affected, and the damage is gradually increasing and spreading. Infested nuts are not only a total loss but are very hard to detect, a large amount of extra labour being required, and even then some are included in the picking.

While the insect in all its stages closely resembles the codling moth, its occurrence in walnuts shows no connection with apple and pear trees, and judging from its feeding habits it is a different form from that which ordinarily attacks those fruits. Its dissemination has been largely due to sacks from infested orchards being taken into uninfested places.

LIZER (C.). **La *Icerya brasiliensis,* nueva para la Fauna argentina.**—*Physis, Buenos Aires,* iv, no. 17, 20th December 1918, pp. 331-332. [Received 28th May 1919.]

The Coccid, *Icerya brasiliensis,* found early in May on jacarandá [rosewood], is recorded from Argentina.

FRERS (A. G.). **Metamorfosis de la *Lema bilineata,* Germ.**—*Physis, Buenos Aires,* iv, no. 17, 20th December 1918, pp. 336–339, 12 figs. [Received 28th May 1919.]

Observations are recorded from various localities in the Province of Buenos Aires on the Chrysomelid, beetle, *Lema bilineata,* Germ., which was found in all stages from November to April feeding on the leaves of *Salpichroa rhomboidea.* The various stages are described. The eggs are laid on the under-side of the leaves in masses of 20 to 30 or more. The larvae feed on the leaves until mature and in captivity pupated between the leaves on which they were fed, though in nature it is probable that they descend to the ground for pupation, as no pupae could be found upon the food-plants. The pupal stage lasts 15 to 20 days. Adults were observed at the end of May under the bark of trees, especially of *Eucalyptus.*

BLANCHARD (E. E.). **Una nueva Especie de *Aleurothrixus* (Homoptera, Aleurodidae).**—*Physis, Buenos Aires,* iv, no. 17, 20th December 1918, pp. 344–347, 6 figs. [Received 28th May 1919.]

Aleurothrixus graneli, sp. n., is described from leaves of *Ipomaea* sp. and from jasmine leaves that were completely withered by the attacks of this species.

BRÈTHES (J.). **Un Bembécido Cazador de Hemipteros.** [A Bembecid predaceous upon Hemiptera.]—*Physis, Buenos Aires,* iv, no. 17, 20th December 1918, pp. 348–349. [Received 28th May 1919.]

Larvae of Rhynchota found in the nest of the Bembecid wasp, *Bembidula discisa,* Tasch., included *Edessa meditabunda,* L., *Spartocerus brevicornis,* Stål, and *Pachylis argentinus,* Berg.

Bruch (C.). **Captura de Cerambícidos.**—*Physis, Buenos Aires*, iv, no. 17, 20th December 1918, 354–355, 1 fig. [Received 28th May 1919.]

In view of the quantities of wood and timber that have been brought down from the northern forests, many Longicorn beetles have been introduced during the last few years that were formerly unknown or very rare in the Province of Buenos Aires, Argentina. *Hamaticherus lacordairei* Gah., for example, is frequently observed in the heart of the capital, while other introduced species characteristic of the northern provinces are *Calocomus desmaresti*, Guér., *Macroeme priapica*, Thoms., *Chlorida festiva*, L., *Eburia sordida*, Burm., *Orion patagonus*, Guér., *Neoclytus famelicus*, Burm., *Trachyderes sulcatus*, Burm., and *Basipterus castaneipennis*, Thoms. A more interesting discovery is that of *Phoracantha semipunctata*, F., a native of Australia. The first individual of this species was captured in Belgrano in January 1917, since when several have been taken in various localities. It has been previously recorded from Brazil, and is now perhaps acclimatised on some native plant and probably also attacks *Eucalyptus*, which has been introduced from Australia.

Bertrand (G.) & Rosenblatt (M.). **Action toxique comparée de quelques Substances volatiles sur divers Insectes.**—*C.R. hebdom. Acad. Sci., Paris*, clxviii, no. 18, 5th May 1919, 911–913.

Experiments have been carried out to test the comparative values as insecticides of ordinary anaesthetics, such as ether, chloroform, carbon bisulphide and carbon tetrachloride; irritants, such as monochloracetone and benzyl bromide; substances at the same time irritating and suffocating, such as nitrochloroform or chlorpicrin; and simple poisons, such as hydrocyanic acid. These have been tested for the most part on a single species, the caterpillars of *Malacosoma neustria*, L., occurring in large numbers on elms near the laboratory. As far as material permitted, tests were also made on *Sparganothis pilleriana*, *Polychrosis botrana*, a Noctuid, and a sawfly.

The insects were subjected to the action of known mixtures of air and the poison vapour, in the manner already described [see this *Review*, Ser. A, vii, p. 285], usually for 10 minutes, though in some cases this has been extended to half an hour or an hour, and the following conclusions were reached:—Ether is not very active; exposure to ·5 gm. per litre of air for 10 minutes produces only temporary anaesthesia, one adult larva recovering within a quarter of an hour, and two others after half an hour, all of them spinning their cocoons 4, 5 and 7 days later, respectively; chloroform is rather more active than ether, 3 larvae subjected to the above strength for 10 minutes all recovering after 55 minutes, and being alive but rather inactive 2 days later, while a concentration of 5 to 10 mg. per litre effects a slight anaesthesia; carbon bisulphide is clearly more toxic than either of these, exposure to a strength of ·5 gm. per litre for 10 minutes causing 3 larvae to remain motionless and apparently dead for several days, after which 2 pupated and the third died; carbon tetrachloride acts very like chloroform, but larger doses are always necessary to obtain the same effects; monochloracetone is much more active than the preceding substances,

exposure for 10 minutes to an atmosphere containing a few centigrammes of volatile liquid per litre causing death; benzyl bromide at a strength of a few centigrammes a litre causes a passing excitement and lively contortions, from the point of view of toxicity coming between carbon bisulphide and monochloracetone; chlorpicrin is still more active than monochloracetone, a few milligrammes per litre being sufficient to cause death sooner or later; hydrocyanic acid in slight concentrations causes an anaesthesia or complete paralysis resembling death, but after a time the larvae revive and slowly recover their functions, doses larger than those of chlorpicrin being necessary to cause death.

There does not seem to be any difference in the toxicity of these substances for the other species experimented upon, the outstanding fact being the great insecticidal value of chlorpicrin, which is at least equal in practice to that of hydrocyanic acid.

VUILLET (A.). **Note sur *Picromerus bidens*, L., Hémiptère prédateur des Larves de Chrysomélides.**—*Bull. Soc. Entom. France, Paris*, 1919, no. 6, 26th March 1919, pp. 118–119. [Received 28th May 1919.]

The bug, *Picromerus bidens*, L., has been observed to be predaceous on the larvae of *Melasoma populi*, L., and *M. tremulae*, F., infesting young poplars in the department of Seine-et-Oise in October 1918; dead larvae were only attacked in the absence of living ones.

WILLIAMSON (W.). **Some Insect Enemies of Corn.**—*Minnesota Agric. Exten. Div., Univ. Farm, St. Paul*, Spec. Bull. no. 8, July 1916, 14 pp., 11 figs. [Received 28th May 1919.]

This popular bulletin describes the commoner insect pests of maize and gives the usual remedial measures.

RUGGLES (A. G.). **The White-marked Tussock Moth.**—*Office of State Entomologist, St. Paul, Minn.*, Circ. no. 42, 5th April 1917, 4 pp., 3 figs. [Received 28th May 1919.]

A short life-history of the well-known shade-tree pest, *Hemerocampa leucostigma*, S. & A., is given, with particulars of remedial measures [see this *Review*, Ser. A. v. p. 174, and vi, p. 330, etc.].

WASHBURN (F. L.). **The Hydrocyanic Acid Gas Treatment for the Flour Moth.**—*Office of State Entomologist, St. Paul, Minn.* Circ. no. 46, 15th January 1918, 13 pp., 1 plate, 4 figs. [Received 28th May 1919.]

This circular, which is a reprint of an earlier one, gives detailed instruction for the fumigation of flour mills with hydrocyanic acid gas as a remedy for infestation with *Ephestia kühniella* (Mediterranean flour moth). It is considered that control by heating, when all parts of the mill are maintained at a temperature of from 123° to 125° F. for several hours, is preferable to any other method when feasible.

GAHAN (A. B.). **New Reared Parasitic Hymenoptera with some Notes on Synonymy.**—*Proc. U.S. National Mus., Washington, D.C.*, lv, no. 2261, 1919, pp. 113-128.

The new Hymenopterous parasites dealt with in this paper include :—ICHNEUMONIDAE : *Phaeogenes* (*Centeterus*) *ineptifrons*, sp. n., from Washington, D.C., a parasite of *Cydia* (*Laspeyresia*) *molesta*, Busck ; *Dacnusa iridicola*, sp. n., from Pennsylvania, infesting *Agromyza laterella*, Zett., 14 females being reared from puparia of this European fly infesting *Iris*.

BRACONIDAE : *Trioxys cupressicola*, sp. n., from California, reared from an undescribed Aphid, *Cerosipha* sp., infesting *Cupressus* ; *Chelonus* (*Chelonella*) *proteus*, sp. n., from Maryland, reared from larvae of *Stagmatophora gleditschiaeella*, Chamb., infesting the spines of the honey locust tree (*Gleditsia triacanthos*) ; *Bassus immaculatus*, sp. n., from Louisiana, reared in connection with *Phthorimaea striatella*, Murtf., and possibly parasitic on that moth ; *B. usitatus*, sp. n., from Massachusetts, reared in cages containing *Mineola vaccinii*, Riley (cranberry fruit-worm), and probably parasitic on it ; *Apanteles stagmatophorae*, sp. n., from Maryland, reared from cocoons found in burrows of the larvae of *Stagmatophora gleditschiaeella*, Chamb. ; *Orgilus dioryctriae*, sp. n., from California, reared from *Dioryctria xanthaenobares*, Dyar, on *Pinus attenuata* ; *O. mellipes*, Say, reared in Louisiana from *Phthorimaea glochinella*, Z.

Chalcidoidea : *Pseuderimerus mayetiolae*, gen. et sp. n., from California, reared from *Mayetiola destructor*, Say ; *Heteroschema prima*, gen. et sp. n., and *Habrocytus simillimus*, sp. n., from Arizona, reared from the pupa of *Agromyza gibsoni*, Mall., there being a possibility that the latter may prove to be identical with *H. languriae*, Ashm., reared from *Languria mozardi*, which like *A. gibsoni* is a stem-borer in lucerne and related plants ; and *Eutelus mayetiolae*, sp. n., from California, reared from puparia of *Mayetiola destructor*, Say.

FISHER (W. S.). **Five new species of Ptinid Beetles.**—*Proc. U. S. National Museum, Washington, D.C.*, lv, no. 2271, 1919, pp. 295-299.

A few apparently new Ptinids reared in connection with the work on insects infesting forest trees are described in order that the names may be available for use in economic publications. They are :—*Ptinus huesanus*, sp. n., from Florida, on *Icthyomethia piscipula* ; *Oligomerus arbuti*, sp. n., from California, on dead manzanita (*Arbutus* sp.) ; *Ernobius conicola*, sp. n., from California, reared from larvae feeding on green and dry cones of *Cupressus macrocarpa* ; *E. californicus*, sp. n., from California, reared from bark and outer wood of branches of recently killed *Pinus jeffreyi* ; *E. champlaini*, sp. n., from Colorado, reared from dead limbs of *Pinus flexilis*.

SASSCER (E. R.) & BORDEN (A. D.). **The Rose Midge.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 778, 3rd May 1919, 8 pp., 2 figs.

Neocerata (*Dasyneura*) *rhodophaga*, Coq., causes considerable damage to the flowers and leaf-buds of roses grown under glass. A list of various roses attacked is given and all stages of this midge are described.

The eggs are laid between the sepals of the flower-buds or between the folded leaves of the leaf-buds. They hatch in two days and the larvae attack the buds causing them to dry up and die. On reaching maturity after about 5 to 7 days, they drop to the ground and pupate in silken cocoons. After 5 to 7 days the adults appear and very soon commence oviposition, their life lasting only from 1 to 2 days. The total cycle under greenhouse conditions is from 12 to 16 days. Larvae have been seen in February but seem to be most abundant from May to July and September to November. They hibernate in the cocoons.

Experiments with various remedial measures have shown that *Neocerata rhodophaga* may be kept in check by applications of tobacco dust to the soil and persistent, nightly fumigation with tobacco. If earthen walks are present, they should be sprayed with a 5 per cent. or 10 per cent. kerosene emulsion. One U.S. qt. of soft-soap or ½ lb. of fish-oil or laundry soap are dissolved in one U.S. gal. of boiling soft water to which 2 U.S. gals. of kerosene are added and stirred until a creamy mixture is obtained. This may be diluted to a 10 per cent. solution by the addition of 5¾ U.S. gals. of water.

WEISS (H. B.) & DICKERSON (E. L.). **Insects of the Swamp Rose-mallow, *Hibiscus moscheutos*, L., in New Jersey.**—*Jl. New York Entom. Soc., Lancaster, Pa.*, xxvii, no. 1, March 1919, pp. 39–68, 3 plates.

Hibiscus moscheutos is associated in New Jersey with the following insects, the life-histories of which are dealt with at length:—Coleoptera: *Rhaeboscelis tenuis*, Lec., *Conotrachelus fissiunguis*, Lec., *Apion hibisci*, Fall, *Bruchus hibisci*, Oliv., and *Chaetocnema quadricollis*, Schwarz; Lepidoptera: *Gelechia hibiscella*, Busck, *Tarache* (*Acontia*) *delecta*, Wlk., and *Papaipema nebris*, Gn. (*nitela*, Gn.); and a Cecidomyiid, *Neolasioptera hibisci*, Felt.

HAVILAND (M. D.). **The Bionomics of *Aphis grossulariae*, Kalt., and *Aphis viburni*, Schr.**—*Proc. Camb. Phil. Soc., Cambridge*, xix, no. 5, pp. 266–269.

Aphis grossulariae, Kalt., is a serious pest of currant and gooseberry bushes in Britain. It attacks the young shoots in May and when abundant causes such distortion that growth ceases and a dense cluster of leaves is formed, under which the Aphids swarm. Its life-history is not fully known. It remains on currants until the middle or end of July. The sexuales have never been found. Its resemblance to *A. viburni*, found on guelder rose (*Viburnum opulus*), is so close that there appears to be no structural difference between the two species, though with alcohol stains different properties have been observed. Experiments were made to test how far these food-plants are interchangeable, and the results of transference of *A. viburni* from *Viburnum opulus* to *Ribes rubrum* and of *A. viburni*, self-established on *R. rubrum*, to *Viburnum* are shown in tables. In the first case only two colonies survived for more than ten days, reproduction being very feeble and never occurring beyond the third generation; an attempt to re-transfer the third generation back from currant to guelder rose

resulted in the death of all the Aphids within 24 hours. In the second case, no colonies survived more than six days, and reproduction was very feeble. Natural colonies on both hosts flourished meantime from late May to mid-August and the end of July respectively. *A. grossulariae* has not been recorded from other food-plants, but during June three instances were observed where winged migrants established themselves on the flower-heads of *Campanula*, the colonies persisting for two or three weeks.

The conclusions suggested by the foregoing observations are that, as pointed out by Theobald, *A. grossulariae* is probably identical with *A. viburni.* The first migrant from *Viburnum* can form colonies either on *Viburnum*, which is the natural host, or else on *Ribes*. The descendants of the migrants to *Viburnum* can with difficulty be established on currant, though the resulting colonies are not so strong as those derived from an early migrant. The descendants of the migrants to currant cannot be re-established on *Viburnum*. It seems as though in two or three generations some change takes place in the currant form which prevents it from flourishing on guelder rose. One explanation is that there is some change in the constitution of *Viburnum*, such as an increase of tannins, and that the strain on this plant can gradually adapt itself to altered conditions which the newly transferred currant-reared stock cannot tolerate. Though Theobald has suggested that *A. grossulariae* may be the alternating form of *A. viburni*, he has twice failed to transfer the former to *Viburnum*. It is also possible that *A. grossulariae* is not the natural summer form of *A. viburni*, but is merely a casual pest of the currant. In the case of Aphids that have a regular migration between two plants, the change is usually from a woody-stemmed primary to a herbaceous secondary host, and if in the case of *A. viburni* the currant should be found to be the normal second host, it would be a remarkable exception to this rule. Possibly the species has not yet adapted itself to the conditions of modern fruit-growing. In a natural state the Aphids are probably able to follow the whole life-cycle on *Viburnum*, but the spread of the cultivated currant has presented them with an increasing supply of alternative food which induces a change that makes a return to *Viburnum* impossible. Whether sex-producing forms can arise from the currant stock, and thence return to the guelder rose, is not known. Otherwise the infestation of the currant must be regarded as an unfortunate accident in the history of the species, which entails a waste of migrating individuals upon a cultivated plant that might otherwise have perpetuated themselves on the natural host. It is obvious that infested *Viburnum* should not be allowed to exist in the neighbourhood of currant bushes.

BYARS (L. P.) & GILBERT (W. W.). **Soil Disinfection by Hot Water to control the Root-knot Nematode and parasitic Soil Fungi.**—*Phytopathology, Baltimore, Md.*, ix, no. 1, January 1919, p. 49.

Experiments made to disinfect small quantities of soil infested with *Heterodera radicicola* by means of hot water are described. When four-inch pots were immersed for 5 minutes in boiling water all the Nematodes were killed. The same result was obtained by the application of about 1 U.S. gal. of boiling water to eight-inch pots

or seven U.S. gals. of boiling water per cubic foot of infested soil in shallow benches. The percentage of germination and the size and vigour of the plants grown in the treated soil showed a marked increase.

BYARS (L. P.). **Experiments on the Control of the Root-knot Nematode, *Heterodera radicicola* (Greef) Mueller. I. The Use of Hydrocyanic Acid Gas in Loam Soil in the Field.**—*Phytopathology, Baltimore, Md.*, ix, no. 2, February 1919, pp. 93-103, 1 plate.

Experiments were made in Florida in 1916 and 1917 to eradicate *Heterodera radicicola* from fields by means of the introduction into the soil of hydrocyanic acid gas. Though apparently more efficient than most chemicals when used on a small scale this substance failed on large areas. The experiments were made at the rate of 3,600 lb. and 5,400 lb. respectively per acre. The same effect is obtained with both the powdered or liquid form of the poison. Particulars are given of each experiment.

BYARS (L. P.). **The Nematode Disease of Wheat caused by *Tylenchus tritici* (Steinbuch) Bastian, and its Control.**—*Phytopathology, Baltimore, Md.*, ix, no. 1, January 1919, p. 51.

Great damage to wheat in 1918 by the eelworm, *Tylenchus tritici*, occurred in all parts of the United States, especially Virginia. The wheat spikelets developed hard galls filled with larvae of this Nematode. From these galls they escape to the soil and settle between the leaf sheaths near the bud of the young seedlings and are thus passively elevated to the spike. Here they enter the flowers, where they produce galls in which they remain until they reach maturity when oviposition takes place in the gall. This pest may be kept in check by the use of clean seed, crop rotation, etc. The sound grain may be separated from the galls by A. G. Johnson's salt brine method for removing ergot from rye.

RUGGLES (A. G.). **Life History of an Oak Twig Girdler, *Agrilus arcuatus*, Say, and var. *torquatus*, Lec.**—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St. Paul*, 1st December 1918, pp. 15-20, 3 figs., 1 plate. [Received 21st May 1919.]

Local damage to oak trees is recorded in Minnesota, due to a small Buprestid larva identified as *Agrilus arcuatus*, Say, var. *torquatus*, Lec., which burrows beneath the bark at the tip of the twigs. A similar species, *A. bilineatus*, Web. [see this *Review*, Ser. A, iii, p. 331], infests the same species of oaks, particularly *Quercus rubra*, L., and attacks the trunk and larger limbs, while *A. arcuatus* works downward, often cutting off branches 8 feet long.

The adults appear throughout July. The eggs are usually laid singly on the side of the twig near the terminal bud, and hatch in about 10 days, the larva at once entering the bark and burrowing in the cambium during July, August and September. In May and June of the year following oviposition they are still working just beneath the bark, but in July, August and September they burrow to the centre of the twigs and work back to the bark during October, often encircling a main branch, which dies during the following year.

Pupation is completed by June of the second year following oviposition. The only possible remedial measure on large shade-trees would be to prune all small dead branches and burn them, but the cost of labour of such a measure is practically prohibitive. It is possible that spraying the trees with Bordeaux mixture or lime-sulphur might act as a preventive. A Hymenopterous parasite, a new species of *Tetrastichus*, has been reared from larvae and pupae taken in the burrows of this twig-girdler.

GRAHAM (S. A.). **Potato Spraying in Minnesota.**—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St., Paul*, 1st December 1918, pp. 21–31, 1 fig. [Received 21st May 1919.]

Experiments to test the value of various insecticides for spraying potatoes were made during the spring of 1918 on a modified co-operative scheme, all the spraying, mixing of materials and taking of observations being done by the Experiment Station, and a standard type of spraying machine being used on land owned by a single person. The pests present were *Leptinotarsa decemlineata*, Say (Colorado potato beetle), *Epitrix cucumeris*, Harr. (potato flea-beetle), and *Empoasca mali*, Le B. (leaf-hopper). In addition to these *Lygus pratensis*, L. (tarnished plant-bug) and several other bugs were common.

The stomach poisons tested were lead arsenate, zinc arsenite, calcium arsenate and Paris green, each of these being applied with and without Bordeaux mixture. The arsenical sprays were applied to the early and late potatoes on 13th and 14th June when the plants were 8 and 6 inches high respectively and infested with *L. decemlineata* and *E. cucumeris*. All four of the poisons tested were equally effective under ideal conditions against *L. decemlineata*, the quantities used being 2 lb. to the acre, or 4 lb. to each 100 U.S. gals. of liquid, except in the case of Paris green, which was 1 lb. to the acre or 2 lb. to each 100 U.S. gals. of liquid, and each was applied with and without 4–4–50 Bordeaux mixture. All of them, however, appeared ineffective as a poison or deterrent for the adult flea-beetles. A second spray applied about 1st July with similar dilutions gave almost perfect control in each case, the plants then presenting a large unpoisoned surface, but the beetles being present in only small numbers. On another block spraying was deferred till 29th June, Paris green, lead arsenate and zinc arsenite being used at the above dilution. The treatment was repeated on 23rd July when the infestation was so slight that it was not commercially profitable. A heavy dose of 2 lb. lead arsenate and 1 lb. Paris green per acre was used, the beetles being thereby almost entirely exterminated.

From these experiments it is evident that all four poisons are equally effective against *L. decemlineata* under favourable conditions, and that the choice of one of them must depend upon its cost and adhesive power. To determine the latter point a series of experiments with glass slides and geranium leaves was undertaken, and it was found that Paris green was the least, and calcium arsenate the most adherent, zinc arsenite and lead arsenate being intermediate. In computing the cost of an arsenical the proportion of arsenic present must be considered, and thus Paris green and lead arsenate cost about the same, for though the price of the former is double that of the latter,

it contains twice as much arsenic. Since calcium arsenate costs rather less than lead arsenate and also has a higher coefficient of adhesion, it stands far above all other materials for potato spraying.

The only contact insecticides used against leaf-hoppers were nicotine compounds applied with and without soap, and only in the latter case were they effective in destroying the insects. The present mechanical methods of applying these materials are, however, faulty, and future efforts should be directed towards improved methods of application.

Graham (S. A.). **The Carpenter Ant as a Destroyer of Sound Wood.**—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St. Paul*, 1st December 1918, pp. 32–40, 8 figs. [Received 21st May 1919.]

The carpenter ant, *Camponotus pennsylvanicus*, DeG., and its variety *ferrugineus*, F., are well known to occur in decaying wood, but have not been regarded as pests of sound trees or timber. It is now established, however, that they are doing considerable damage to standing white cedar in Minnesota, at least 20 per cent. of the trees cut showing injury by ants to the stump. So far as observed, a perfectly sound tree is never attacked, but entrance is gained through a wound or a decayed spot usually near the ground, or even below the ground level. The ants hollow out a nest in the heart of the tree, sometimes leaving only a thin shell of wood round it, and thus seriously weaken the tree at that point. From the nest they cut openings to the outside called windows, from the presence of which a nest is easily located. The height at which nests occur varies greatly, but they are usually within 6 feet of the ground. The percentage of ant-infested cedars varies with the conditions under which the trees are growing, those in the swamps being much less heavily infested than those growing on higher ground. This may be due to the fact that the wet condition of the ground tends to increase the moisture in the nests. The percentage of trees with heart rot is also greater on the dry ground than in the swamps and the wood of those grown in the latter situation is much heavier and closer grained, and these factors may limit the extent of infestation.

No means of protecting cedar trees in the woods from ant attack can be recommended at the present time, but intelligent trimming of poles together with closer utilisation of ant-infested cedar would result in the saving of an immense amount of merchantable timber.

Oestlund (O. W.). **Contribution to Knowledge of the Tribes and Higher Groups of the Family Aphididae (Homoptera).**—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St. Paul*, 1st December 1918, pp. 46–72. [Received 21st May 1919.]

This systematic paper, which aims at bringing the arrangement of the tribes and groups of the family Aphididae up to date, attempts to give proportionate consideration to the historical, morphological and biological aspects as necessary foundations of a natural classification. Keys are given to the sub-families, groups and tribes.

CHAPMAN (R. N.). **The Confused Flour Beetle** (*Tribolium confusum*, Duval).—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St. Paul*, 1st December 1918, pp. 73–94, 3 plates, 1 fig. [Received 21st May 1919.]

The subject-matter of this paper has already been noticed from another source [see this *Review*, Ser. A, vii, p. 221].

WILLIAMSON (W.). **The Clover-seed Chalcid,** *Bruchophagus funebris*, **Howard.**—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St. Paul*, 1st December 1918, pp. 95–110, 10 figs. [Received 21st May 1919.]

The bulk of the subject-matter of this paper has already been noticed [see this *Review*, Ser. A, iii, p. 185]. The three known Chalcid parasites of this clover pest are *Tetrastichus bruchophagi*, Ashm., *Habrocytus medicaginis*, Gah., and *Idomacromerus longfellowi*, Gir.

The food-plants are red clover, crimson clover, bur clover and alfalfa; alsike, white clover and sweet clover are apparently immune to attack.

HOWARD (C. W.). **A Preliminary Report on the Trombidiidae of Minnesota.**—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St. Paul*, 1st December 1918, pp. 111–144, 7 plates. [Received 21st May 1919.]

This paper deals with a number of Trombidiid mites, with keys to the adults, nymphs and larvae. Among those mentioned are:—*Allothrombium pulvinus*, Ewing, which is a species that is very beneficial in the control of Aphids, as every stage feeds on them, even destroying the winter eggs, while on the other hand it seems to have few enemies. *Eutrombidium locustarum*, Walsh, is apparently present throughout all the grasshopper areas of the State, the adults being found on or in the soil in open ground during early spring. With the advent of warm weather they emerge in search of grasshopper eggs, and in the breeding-grounds they are so abundant as to give the soil a scarlet appearance. Their distribution is not influenced by the character of the soil, and they may be found on dry, sandy hillsides or in low, wet bottom lands, providing grasshopper eggs of some species are present. This mite has been found to infest the eggs of *Melanoplus bivittatus*, *M. femur-rubrum*, *M. atlantis*, *M. minor* and *Chorthippus* (*Stenobothrus*) *curtipennis*. In from 9 to 12 days after engorgement the female oviposits in a smoothed-walled chamber in the soil, ½-inch to 1 inch below the surface, the egg-masses consisting of from 300-700 eggs, which hatch in from 24 to 30 days. As soon as they hatch the larvae crawl in search of grasshoppers of any stage, to which they attach themselves between the segments, under or on the wing pads, or at the joints of the tarsi or near the mouth. They will attack *Tettix* sp., *Melanoplus bivittatus*, *M. femur-rubrum*, *M. gladstoni*, *Chorthippus curtipennis*, *Orphulella speciosa* and *O. pelidna*, as many as 124 larvae having been counted on a single grasshopper nymph. The fully engorged larva enters the soil, from which the nymph emerges

in about 5 days, beginning at once to feed on grasshopper eggs and becoming engorged after 14–20 days. It again enters the soil and passes through a transformation stage from which the adult emerges during late August; it may then begin feeding or go at once into hibernation. The economic importance of *E. locustarum* is undoubtedly great, the nymphs and adults destroying large numbers of grasshopper eggs, though the larvae, even if present in large numbers, do little more than weaken the grasshoppers to which they attach themselves.

The adult of *Microtrombidium muscarum*, Riley, has not been collected in Minnesota but must occur there, as what is probably the larva has been found on three occasions, twice on adults of *Musca domestica*, and once in a manure heap.

Washburn (F. L.). **The Hymenoptera of Minnesota.**—*17th Rept. Minnesota State Entomologist, Agric. Expt. Sta., Univ. Farm, St. Paul*, 1st December 1918, pp. 145–237, 100 figs., 3 coloured plates. [Received 21st May 1919.]

This important work embodies the results of several years' investigation, all species collected and determined up to date being listed and those of economic importance being emphasised.

Washburn (F. L.) & Howard (C. W.). **Household Insects.**—*Office of Minnesota State Entomologist, Univ. Farm, St. Paul*, Circ. no. 44, 15th October 1917, 14 pp., 7 figs., 1 plate. [Received 28th May 1919.]

Among the insects dealt with in this paper, which is compiled from previous circulars, are *Phyllodromia germanica* (croton bug), clothes moths, buffalo carpet beetle [*Anthrenus scrophulariae*], silver fish [*Lepisma*], ants in the house and garden, and bean weevils.

Fullaway (D. T.). **Report of the Entomologist.**—*Rept. for the Bien. Period ending 31st December 1918, Territory of Hawaii Bd. Agric. & Forestry, Honolulu*, 1919, pp. 54–60. [Received 3rd June 1919.]

The propagation and distribution of beneficial insects have been continued during the year, the species and localities to which they were sent being shown in a table. This work might be very profitably extended, especially for the control of the corn leaf-hopper [*Peregrinus maidis*] in the lowlands, where maize cultivation is confined to the winter months and where there is great destruction of the parasite [*Paranagrus*] during the off-season. Reports of work done by the United States Bureau of Entomology in the control of the Mediterranean fruit-fly, which have been noticed in this *Review*, are quoted at length. No unusually serious insect menace appeared during the period under review, with the exception of a heavy infestation of bananas by mealy-bugs in the summer of 1917. Attention is drawn to the alarming and increasing ravages of termites. One recently observed species is becoming very destructive to all kinds of timber and wood products, and a study of it is being made.

EHRHORN (E. M.). **Report of the Chief Plant Inspector.**—*Rept. for the Bien. Period ending 31st December 1918, Territory of Hawaii Bd. Agric. & Forestry, Honolulu,* 1919, pp. 61–85, 3 plates. [Received 3rd June 1919.]

An account is given of the work of plant inspection during the period under review, and is summarised in tables. The new inspection buildings, and particularly the fumigation huts, have given greatly improved facilities for this work. Large consignments of wheat from Australia infested with *Rhizopertha dominica* (lesser grain borer) were cleansed by fumigation.

The following interceptions of insects are among those mentioned:—*Stigmaeus floridanus* (pineapple mite) from Florida, which, besides the damage done in feeding, carries dangerous plant diseases that gain access to the tissues of the leaves of pineapple through its punctures; *Iridomyrmex humilis* (Argentine ant), in the soil around plants from California; a Curculionid beetle from the roots of potted plants, and *Aleurodes citri* on citrus plants from Japan.

A copy is given of the rules and regulations of the Board of Agriculture and Forestry pertaining to the Plant Inspection Division that have been drawn up during the past two years, as well as all quarantine notices and other restrictive orders.

FULLAWAY (D. T.). **The Corn Leaf Hopper** (*Peregrinus maidis*, **Ashm.**).—*Hawaii Bd. Agric. Forestry, Honolulu,* Div. Entom., Bull. no. 4, 27th December 1918, 16 pp., 18 figs. [Received 3rd June 1919.]

To growers in the Hawaiian Islands the control of the leaf-hopper, *Peregrinus maidis*, Ashm., is a serious problem. This insect is closely related to the sugar-cane leaf-hopper [*Perkinsiella saccharicida*], but in Hawaii is found only on maize. In confinement it will oviposit in stems of sugar-cane and *Coix lachryma*, but the nymphs apparently cannot develop on these food-plants. When it is abundant on maize the plant withers as if suffering from drought. The hoppers are distributed mainly by flight, and also by hopping from adjacent fields and by wind-dispersion. The eggs are deposited principally in the midrib on the upper surface of the leaves, from one to four being loosely packed in each cavity. These hatch in summer in 9 days, but in cold, dry weather may take 14 days. The nymphal stage lasts from 15 to 21 days, during which 5 moults occur. Dimorphism is frequently found among the adults, both long and short winged forms occurring. Mating and oviposition take place as soon as the adult insects appear, each female depositing an average of 200 eggs. The life-cycle occupies about one month, and as maize plants require from 100 to 120 days to mature, it is obvious that several generations of hoppers may be present on the plants simultaneously. Artificial remedial measures have not been applied to *P. maidis* to any great extent. It might be possible to reach the nymphs, which are the most injurious stage, with a kerosene or nicotine spray, but it would have to be weak to avoid injury to the plants and might seriously interfere with the egg-parasites. Hopperdozers also might be successful. The most effective checks so far have been insect parasites and judgment on the part of the grower as to time of planting.

Parasites developing in the egg include the two Mymarids, *Paranagrus osborni* and *Anagrus frequens*, the parasitism averaging about 50 per cent. The latter was introduced from Australia about 1904 to control *Perkinsiella saccharicida*, and has also been bred from the eggs of a native species of sweet potato leaf-hopper. *Paranagrus osborni* was introduced from the Philippine Islands in 1916 to control the maize leaf-hopper. Usually one egg only is laid in the host-egg, and this hatches within 24 hours. The larva grows until it nearly fills the eggshell; on the 6th day it pupates within the shell of the egg it has consumed and 5 days later emerges as an adult. Males are scarce in these species, a great deal of the reproduction being parthenogenetic. The short life-cycle (11 to 12 days in summer at sea-level) is the most important factor in the abundance of this parasite.

Two species of Tetrastichine egg-parasites occur, viz.:—*Ootetrastichus beatus*, and an undescribed species commonly known as the Formosan *Ootetrastichus*. The former was introduced from Fiji in 1905, the latter from Formosa in 1916. The egg of *O. beatus* hatches in from 2 to 3 days, pupation occurring about 9 days later and the adult emerging in another 10 days. Males of this species have never been seen, reproduction being entirely parthenogenetic.

A Dryinid parasite, *Haplogonatopus vitiensis*, develops on the nymphs of the leaf-hopper, the larva feeding on the fatty tissues of the body. This parasitism is indicated externally by a small sac that usually appears on the host-nymph behind the tegmina about 10 days after oviposition. When mature, the larva emerges from the sac, leaving the hopper to its fate, and pupates for a period of several weeks. This parasite is too rare to be of great value and is abundantly hyperparasitised. Pipunculid flies and Stylopid beetles also parasitise *P. maidis*, although their effect has not been observed. Predaceous enemies include an ant (*Pheidole megacephala*), a Coccinellid (*Coleophora inequalis*), a bug (*Zelus peregrinus*), an earwig (*Chelisoches morio*) and spiders.

BRAIN (C. K.). **A Preliminary Report on the Cotton Pests of South Africa.**—*Union S. Africa Dept. Agric., Pretoria*, Local Ser. no. 59, 26th August 1918, 29 pp., 24 figs. [Received 3rd June 1919.]

There are many problems to be solved before the cotton-growing industry can be established in South Africa on as large a scale as is desirable. As the insect fauna of the country is exceptionally rich, and as the flora comprises a large number of wild plants more or less closely related to cotton, the question of insect pests is a most important one, since it is highly probable that when cotton is grown to any extent, pests will be discovered that are peculiarly South African. At present, however, all the insect pests known to cotton growers are well known in other parts of the world. Little study has been given to them in South Africa, and the accounts given in this paper are taken from the records of other cotton-growing countries. It is desirable to obtain definite information for South African conditions, and much of this could be supplied by cotton growers. Remedial measures practised in other countries may not be suitable in South Africa, but the remedies generally recommended are given for reference and trial. Two of the most serious cotton pests, the boll-weevil [*Anthonomus grandis*] and the

pink bollworm [*Pectinophora gossypiella*] have not yet appeared in the country, and strict quarantine measures in respect of imported seed are taken by the Government.

The cotton pests dealt with include *Agrotis ypsilon* and other cutworms; *Aphis gossypii*, Glov.; *Prodenia litura*, F., which in South Africa also feeds on sunflowers; *Laphygma exigua*, Hbn., on many food-plants and chiefly in lawns; the bollworms, *Heliothis* (*Chloridea*) *obsoleta*, F., *Earias insulana*, Boisd., and *Diparopsis castanea*, Hmps., which last is known in S. Africa as the Sudan bollworm and is abundant throughout the greater part of the country, as much as 60 per cent. of the bolls being damaged in some localities; and the cotton stainers, *Dysdercus superstitiosus* and *Oxycarenus albidipennis*. Minor pests that are not likely to require remedial measures include a Nematode, *Heterodera radicicola*; the beetles, *Strophosomus amplicollis*, *Pachnoda carmelita* and *P. impressa*; the mealy-bugs, *Pseudococcus filamentosus* and *P. virgatus*; and the scales, *Saissetia oleae* and *Pulvinaria jacksoni*.

BRAIN (C. K.). **Pernicious Scale.**—*Union S. Africa Dept. Agric., Pretoria*, Local Ser. no. 61, 17th July 1918, 4 pp., 2 figs. [Received 3rd June 1919.]

A popular account is given of *Aspidiotus perniciosus*, which was introduced into South Africa about twelve years ago and has spread to various centres in the Transvaal, Orange Free State and Natal. Around Pretoria it has spread rapidly, the mode of transmission apparently being chiefly on the feet of birds. It is noticed that trees growing in fowl-runs are very liable to infestation, birds, particularly doves, being attracted by the poultry food. The large beetles that appear when fruit is ripening also greatly assist the spread of the scale on fruit-trees. The usual sprays of miscible oil or lime-sulphur wash are recommended. Government regulations are now in force prohibiting the removal of woody plants from an infested property without permission from the Department of Agriculture [see this *Review*, Ser. A, v, p. 543].

SCHLUPP (W. F.). **Potato Tuber Moth.**—*Union S. Africa Dept. Agric., Pretoria*, Press Circ. no. 46, 23rd November 1918, 2 pp. [Received 3rd June 1919.]

The bulk of the information contained in this circular has already been noticed [see this *Review*, Ser. A, vi, p. 360]. It is pointed out that after deep ploughing, planting in ridges is not wise from the standpoint of control of the potato tuber moth [*Phthorimaea operculella*]. Deep planting and harrowing the ground level after planting is much to be preferred. The use of the ridging plough at the first cultivation is also objectionable; the earthing up should be a gradual process, a little soil being added to the tops of the ridges at each cultivation. About the middle of the growing period the ridging plough should be used. The time of danger is always the latter part of the season and all efforts should be directed towards having a good soil covering at that period.

Schlupp (W. F.). The Control of Insects in the Orchard.—Reprint from *S. African Fruit Grower, Cape Town*, iv, 1918, 29 pp., 5 figs. [Received 3rd June 1919.]

This popular paper has been written for the guidance of South African fruit-growers and gives some account of the commoner insect pests of the orchard, with instructions for remedial measures. Points of interest include the spraying of walnuts against *Cydia* (*Carpocapsa*) *pomonella* (codling moth). The optimum times for this measure seem to coincide with those for the apple, *i.e.*, just after the fruit sets, followed by later sprays. Particular care should be taken with all sprays to cover the stem end of the nuts with poison, as many larvae enter from that end, and also between any nuts that are in contact. The collection and destruction of fallen nuts twice a week is advocated, as the larvae remain longer in them than in most fruits. Besides the well-known fruit-fly, *Ceratitis capitata*, there is a native species, *C. cosyra* [probably *C. rosa*], which has similar life-history and habits and for which the same remedies are effective. Frequent applications of lead arsenate spray are necessary in the Transvaal owing to the continued summer rains; the minimum number for each locality must be learned by experience. *Myzus persicae* (green peach aphis) injures many fruit trees, and, while in cool climates migration back to peach trees occurs in autumn, in South Africa the females remain on cabbages and similar plants throughout the winter, reproducing slowly and migrating back to the peach trees in spring.

Hardenberg (C. B.). Some Insects Injurious to the Black Wattle (*Acacia mollissima*, Wild).—*Union S. Africa Dept. Agric., Pretoria*, Bull. no. 1, 1918, 41 pp., 36 figs. [Received 5th June 1919.]

The cultivation of the black wattle (*Acacia mollissima*), for the sake of its bark for tanning, is of comparatively recent origin and has greatly increased within the last few years. This has naturally led to a large increase in the insect pests of this tree, which have hitherto been but little studied in South Africa. The present bulletin gives an account of the work at the field station for the study of wattle insects at New Hanover, Natal. During these investigations over 150 insects have been found injurious to it; the majority of these are not doing very serious damage, but all are potential pests. Their increase is due to the destruction of native food-plants in making the wattle plantations, to the unlimited food supply afforded by the plantations, and to the greater safety from enemies compared with the exposed life on the veld. The insect fauna of the wattle plantations is divided into three groups, those that are known to be injurious, those that are beneficial, and those that have as yet been insufficiently studied to be classed in either group. The first group includes *Gynanisa maia* (peacock moth), which originally lived on thorn-trees and now prefers wattle; various Lasiocampids found only on wattle; bagworms, which thrive on both thorn and wattle; and species that only sporadically attack wattle, such as various Arctiids, Lycaenids, Lymantriids, wood-boring Cerambycids, etc., and occasionally the Saturniid, *Melanocera menippe*. Beneficial insects include Tachinid flies and the larger parasitic wasps that attack caterpillars. There are also many Chalcid

parasites of the eggs which are of great importance in reducing the numbers. Mantids, Asilids and Odonata destroy both injurious and beneficial insects.

The influence of the present methods of wattle cultivation on the presence, spread and abundance of wattle insects is discussed, and the best methods of preparing the ground, planting and spacing, cultivating, felling and stripping, and burning are explained.

A detailed account is given of the wattle bagworm, *Chalioides* (*Acanthopsyche*) *junodi*, Heylaerts, which is considered the most dangerous pest of black wattle [see this *Review*, Ser. A, i, p. 303, ii, p. 84, v, pp. 378 and 547, etc.]. Various Ichneumonids and parasitic flies help to check the increase of this bagworm, while predaceous enemies and a fungus disease also reduce its numbers, but these do not in themselves constitute a sufficient control. A poison-dust consisting of Paris green and lime (1 : 10), or lead arsenate in the same proportion, kills respectively 76 and 70 per cent. of the bagworms when evenly applied with a dusting machine, about 100 lb. per acre being used. It is thought that a combination of the trap method, with the object of slowly reducing the total number of bagworms over a large area, with dusting to prevent the damage on special plots, will prove to be the solution of the problem of controlling this pest.

RIGNEY (J. W.) & FITE (A. B.). **Nine Year Band Record of the Codling Moth.**—*New Mexico Agric. Expt. Sta., State College*, Bull. no. 110 (Technical), March 1918, 60 pp., 20 figs. [Received 3rd June 1919.]

The codling moth [*Cydia pomonella*] continues to be one of the worst pests of apples in New Mexico, especially in the warm and favourable conditions in the lower irrigated valleys. As little was known of the life-history in these localities, investigations have been carried on for a number of years. In the year 1907, when the work began, an unusually severe and late frost destroyed almost all the fruit in the valley. An experiment was then tried of destroying all the apples left in order to starve the codling moth and ascertain, if possible, whether this would permanently eradicate the pest in the valley. The result was a very heavy crop in 1908, and about 90 per cent. of sound fruit in 1909, but by the end of 1910 the orchards were as badly infested as ever.

Particulars of the banding experiments are given and the results shown in a series of tables, while charts show the daily morning and evening life-curves compiled from observation of the larvae under the bands, daily double-band records and weekly life-curves. The effect of rain and temperature on the movement of larvae was not very pronounced, though on the whole fewer larvae were caught immediately following heavy rain or a decided drop in temperature. Bands of dark-coloured cloth attracted more larvae than light-coloured ones. About three times as many larvae get under the bands in the night as in the day-time. The double-band records show that many more larvae crawl down the trees and under the upper bands than were caught under the lower ones. In examining windfallen fruit, 55·4 per cent. were found to be infested, 80 per cent. of the larvae having left the apples before they fell. It is estimated that from the 114

trees banded, some 35,000 larvae would have been the progeny of the larvae caught by the bands and destroyed. During the three years of weekly banding, it is calculated that about £31 10*s*. worth of apples were saved at a total cost, for bands and labour, of £3 10*s*.

It was found that there were four overlapping generations of the moth, indicating a different length of life-cycle in different individuals. The first larvae were caught on 18th May, with maximum numbers in July and August. Natural enemies observed during these investigations were the larvae of a Clerid beetle, which seem to attack those of *C. pomonella* chiefly while they are in shelter or during pupation in such places as under bark or bands. Lace-wing larvae do not attack the codling moth so much under the bands as in the open. Small red ants destroy a good many larvae, especially under bands and other shelters, and birds, pigs and chickens all prey upon them.

BALL (E. D.) & WALTER (E. V.). **Injury from White Grubs in Iowa.**—*Iowa Agric. Expt. Sta., Ames*, Circ. no. 60, [n.d.] 4 pp., 2 figs. [Received 3rd June 1919.]

During the past ten years there have been serious local infestations of white grubs [*Lachnosterna*] in north-eastern Iowa, which are part of a general outbreak appearing in a number of more or less timbered areas in a belt running from Minnesota and Iowa east to New York, Connecticut and New Jersey. The grubs first appeared in unusual numbers in 1909, increased in 1912 and were most abundant in 1915. The 1918 outbreak was less severe, and it is probable that parasites and other enemies of the grubs will reduce them to nearly normal numbers in 1921 or 1924 at the latest. A map shows the areas that have been most severely affected. It is observed that bad infestations seldom occur very far from timber. The grubs are found under natural conditions only in grass sod, and never travel from one field to another. When grass land infested with them is ploughed up and used for other crops, the grubs are compelled to feed upon whatever they find there. Maize and potatoes suffer most in this way. Small grains are seldom much injured owing to their abundant root-system and early maturity. The life-cycle of these beetles is described and illustrated. Proper crop rotation and autumn ploughing of infested land are the best measures against increase, and the steps to be taken are forecasted for the ensuing years. It is known that the large grubs will come to the surface in the springs of 1919 and 1922 and feed greedily for a short time before they pupate. All sod land intended for cultivation during the next two years should be broken in the autumn of 1919 or the spring of 1920 before the adult beetles emerge. During 1920 and 1923 adults will appear and may defoliate trees but will not injure crops. Small grain should not be planted on land intended for maize in the following year. Lucerne or clover may be broken up in the autumn for maize growing. In 1921 and 1924 maize should not be planted on land that was in grass or grain the previous year if young grubs were present in the early autumn. An infested maize-field might be planted with buckwheat, beans or peas, or possibly millet or sugar-cane if the grubs are not too abundant.

NOWELL (W.). **Investigation of Froghopper Pest and Diseases of Sugar Cane.**—*Trinidad & Tobago Council Paper no. 39 of 1919, Port of Spain*, 20th February 1919, 10 pp. [Received 5th June 1919.]

In consequence of the discovery made by the entomologist in charge of froghopper investigations in Trinidad, that the prevalence in sugar-cane fields of the condition known in general terms as blight in many cases did not correspond with the severity of froghopper infestation, the conclusion was reached that an additional factor must be involved. As it was suspected that this factor was a root disease of fungoid origin, the co-operation of a mycologist with experience of the effects of root disease in places where no complications with froghoppers exist was desired, and the present report embodies the results of the mycologist's observations during the period from December 1918 to February 1919. When the investigation began, infestation by the froghopper [*Tomaspis saccharina*] was practically over for the duration of the current crop, while the period covered, namely, the last weeks of the wet season and the beginning of the dry, was the most suitable for estimating the position held by root disease in the final condition of blighted fields. It was evident from the first that to the froghopper were ascribed practically all the causes that may operate to produce an unhealthy appearance in standing canes. In many fields other adverse conditions were present to a degree that would probably be sufficient to account for the poor state or failure of the yield, but concentration upon the purely entomological aspect of the subject has not only failed to bring the hoped-for relief, but has delayed progress in more promising directions.

Both the onset and persistence of root disease depend on a condition of weakness or debility in the cane, which may be caused by a variety of adverse conditions. The general nature of the disease is discussed, the factors influencing its occurrence and the means that may be adopted for its reduction. Examination of the work of froghoppers in infested cane showed that the insects are capable in some instances of quickly producing severe effects, marked by the drying up of leaves. In the majority of cases, however, where other conditions are good, recovery seems to begin as soon as the infestation is over, and, except for delayed growth, definite recovery generally ensues. It is therefore concluded that froghopper infestation is not capable alone of producing the permanently disabled condition that exists on many sugar-cane areas and this obviously constitutes the really serious feature of the situation. The severity of froghopper injury on fields affected by adverse conditions is explained by the plants lacking full vigour, having an ill-developed root-system, and thus being less able to withstand the drain upon their sap which the feeding of the insects involves. This might account for the drying up of leaves, but does not by itself account, in the case of a plant with the powers of recovery characteristic of sugar-cane, for the continuation of the condition after the infestation has subsided. Nor can anything less than a heavy infestation produce even this effect, and it remains to be shown how the attacks of the small numbers of froghoppers sometimes held responsible can affect so hardy a plant, apart from a toxic influence of which no evidence has been produced. Under the present methods of Trinidad agriculture, a certain amount of root fungus is sure to exist

in the fields, and when such fields are attacked by froghoppers, or become infested with the fungus in consequence of the effects of froghopper attack, the permanence of the result is adequately accounted for and such fields pass into the characteristic condition of blight. It does not follow that all blight is caused in the same way; there may be intense infestation with root disease where froghoppers have never been present.

Remedial measures can only take the form of agricultural practices that will serve to reduce the injury directly caused by froghoppers and prevent the infestation of fields with root disease. Each estate and even each section of each estate will have to be considered separately in determining the nature and application of remedies. In so far as general measures can be advocated, they are discussed under such comprehensive headings as sanitation, rotation of crops and manuring. Between the reaping of one crop and the planting of the next, there should be an early ploughing out of the stools, with subsequent working of the land so that they are broken up and rotted, or they may be collected and allowed to rot in heaps. Burning is not advised owing to the loss of organic matter involved. In the case of land subject to blight, it is necessary to go further and clean up the land thoroughly by leaving out a cane crop and alternating with another, the value of several in this connection being discussed. In some cases, *e.g.*, where it is desired to restore quickly a poor soil, it may be sufficient merely to reduce the number of ratoon crops, without rotation, the extreme of this policy being the growing of plant canes only.

BARNES (W.) & McDUNNOUGH (J.). **Notes on the Genus *Olene* with Description of a New Species.**—*Canadian Entomologist, London, Ont.*, li, no. 5, May 1919, pp. 102–104.

The two species of larvae of *Olene* found in Maine have been previously identified by the authors as *O. vagans* and *O. willingi.* It is now recognised that the identification of the latter moth was incorrect, and the species concerned is here described from examples from Ottawa as *O. dorsipennata*, sp. n., and a key is given to the larvae of the five species of *Olene* now known as feeders on deciduous trees.

FERRIS (G. F.). **Notes on Coccidae. iii. (Hemiptera.).**—*Canadian Entomologist, London, Ont.*, li, no. 5, May 1919, pp. 108–113, 3 figs.

The species dealt with include: *Stigmacoccus asper*, Hemp., of which the penultimate stage is described; *Xylococcus betulae*, Perg., of which *X. alni*, Florence, is regarded as a synonym; *Kuwania quercus*, Kuw., of which the penultimate and first larval stage is described; and *Cissococcus fulleri*, Ckll., of which some particulars of the first stage larva are recorded.

COCKERELL (T. D. A.). **A New Coccid on the Coconut Palm.**—*Canadian Entomologist, London, Ont.*, li, no. 5, May 1919, p. 116.

Furcaspis haematochroa, sp. n., is described from the island of Batbatan, Philippines, the female scales having been taken on leaves of coconut palm.

Report on the Agricultural Department, Tortola, 1917-1918.—*Barbados*, 1919, 12 pp. [Received 5th June 1919.]

During the period under review the cotton crop suffered from severe attacks of cotton worm [*Alabama argillacea*] in December, while internal boll disease appeared later, infection probably being carried by the bugs, *Nezara viridula* and *Dysdercus andreae* (cotton stainer). Onion seeds were shaken up in red-lead powder before sowing, and this was found a very effectual method of protecting them from the depredations of ants. Young bay trees were considerably damaged by *Diaprepes abbreviatus spengleri* (sugar-cane root-borer), the larvae attacking the roots and the adults the leaves and young twigs.

Insects of the Season.—*44th Ann. Rept. (1918) Ontario Agric. Coll., Toronto*, 1919, pp. 15–18. [Received 5th June 1919.]

Owing to the extreme severity and long continuance of the winter in Ontario, insect life during the summer of 1918 was far less abundant than usual, and many pests that had threatened in the previous year to become a serious menace to crops [see this *Review*, Ser. A, vi, p. 412] proved to be of comparatively little importance. Aphids, on the other hand, were more abundant and widely destructive than ever before. White grubs and wireworms were troublesome, particularly on land that had been cultivated after being for some years under grass. *Psila rosae* (carrot rust-fly) was unusually prevalent; its attacks are especially noticeable in early summer, when the leaves of young carrots turn reddish and on examination the roots are found covered with rusty blotches. The eggs are laid on the stem of the carrot just below the surface of the ground and the larvae make their way to the root and tear the tissues; this injury may continue after the roots are placed in winter storage. Celery and parsnips are liable to damage in the same way. Sprinkling the rows of young carrots with sand or plaster mixed with coal-oil, using half a pint to a pailful, or spraying with kerosene emulsion deters the fly from ovipositing on the plants. This should be done as soon as they are ready for thinning out and should be repeated weekly until about the end of June. The parsnip webworm [*Depressaria heracleana*] has again been prevalent, destroying the umbels in the second year of growth when the plant is about to seed. The potato stalk borer [*Gortyna micacea*] has appeared in the extreme south-west of Ontario but is not yet very numerous; cutting out and destroying infested stems appears to be the only remedy. Many threatened losses by insect pests were avoided by timely entomological assistance; for example, in orchards where large quantities of sour cherries had been destroyed in the previous year by fruit-flies, there was very little loss in 1918 owing to the growers having followed instructions given them.

Experiments have shown that for the control of *Rhagoletis pomonella* (apple maggot) the gathering and destruction of fallen fruit is not the only remedy, but that spraying with lead arsenate and water, if applied at the proper times, will completely control this fly and in a couple of years almost annihilate it. A bulletin on this insect is now being prepared. Tests with spray mixtures showed that Bordeaux mixture and lead arsenate gave as good results as lime-sulphur and

lead arsenate as far as dropping of fruit was concerned, and indicated that calcium arsenate may be substituted for lead arsenate with lime-sulphur, and is much cheaper, but cannot be used alone owing to injury to the foliage. The results with dust sprays were again almost as good as those from liquid sprays, though in some orchards examined the liquid spray produced much cleaner fruit. For the control of *Phorbia* (*Chortophila*) *brassicae* (cabbage root maggot) tarred felt paper discs are likely to be superseded by the use of corrosive sublimate applied to the plants at the strength of 1 part to about 1,200 parts water four days after the plants are set out and again three times at intervals of seven days, sufficient fluid being poured around the roots to wet the soil thoroughly as deep as the main root, *i.e.*, from $1\frac{1}{2}$ to 2 inches. Tobacco dust with sulphur and lime gave promising results, but requires further tests. *Fenusa* (*Metallus*) *bethunei* (blackberry leaf-miner) caused great losses in the blackberry industry. In spite of many experiments no satisfactory remedial measure has yet been discovered. Nursery inspection has greatly improved the position with regard to scale infestation. Though *Hemerocampa leucostigma* (tussock moth) laid many egg-masses during the previous autumn on trees in cities and orchards, careful inspection and removal of the egg-masses, and the issue of instructions to fruit-growers in the Province have done much to reduce its numbers, while natural enemies have controlled it to such an extent that it is not expected to be a menace next year.

GIBSON (E. H.). **The Genera *Corythaica*, Stål, and *Dolichocysta*, Champion. (Tingidae: Heteroptera.)**—*Proc. Biol. Soc. Washington, Washington, D.C.*, xxxii, no. 17, 20th May 1919, pp. 97–104.

This paper gives keys to the species of the genera *Corythaica* and *Dolichocysta*, including the following:—*Corythaica monacha*, Stål, which is of considerable economic importance, being a recognised pest of the egg-plant in the West Indies, where it has also been collected from *Ricinus communis*; *C. costata*, sp. n., from Peru, collected from cotton; and *C. carinata*, Uhler, on egg-plant from West Indies, Texas and Central America.

BRITTON (W. E.). **Insects attacking the Potato Crop in Connecticut.**—*Connecticut Agric. Expt. Sta., New Haven*, Bull. no. 208 (Entom. Ser. no. 26), October 1918, pp. 103–119, 8 plates, 6 figs. [Received 5th June 1919.]

The insects dealt with include *Epitrix cucumeris* (potato flea-beetle); *Leptinotarsa* (*Doryphora*) *decemlineata*, Say (Colorado potato beetle), parasitised by the Tachinids, *Doryphorophaga doryphorae*, Riley, and *D. aberrans*, Towns.; *Lema trilineata*, Oliv. (three-lined beetle); the tortoise beetles, *Coptocycla bicolor*, *C. clavata*, F. and *C. guttata*, Oliv.; the blister beetles, *Epicauta pennsylvanica*, DeG. *E. marginata*, F., *E. vittata*, F., and *Macrobasis unicolor*, Kirby, all of which can be controlled by lead arsenate sprays; *Papaipema nebris*, Guen. (*nitela*) (stalk borer), cutworms, wireworms and white grubs. *Macrosiphum solanifolii*, Ashm. (potato Aphis) and *Poecilocapsus lineatus*, F. (four-lined leaf-bug) may be controlled with nicotine and soap solution or kerosene emulsion.

BRITTON (W. E.). **Eighteenth Report of the State Entomologist of Connecticut for 1918.**—*Conn. Agric. Expt. Sta., New Haven*, Bull. no. 211, 1919, pp. 249–352, 16 plates. [Received 5th June 1919.]

This report includes brief accounts of the various branches of entomological work undertaken during the year under review. The 86 nurseries of Connecticut were all inspected during August to October. Attention is called to the great prevalence during 1917 and 1918 of *Lepidosaphes ulmi*, L. (oyster-shell scale), which caused the destruction of much nursery stock, though *Aspidiotus perniciosus* (San José scale) was less numerous. A list of the certified nurseries is published.

The following pests were found on imported nursery stock during 1917–1918: a cocoon of *Acronycta* sp. on rose stock from France; *Alphitophagus bifasciatus*, Say, on rose stock from England; *Anisodactylus binotatus*, F., among evergreens from England and in moss around roses from Ireland; *Chionaspis salicis*, L., in packing from Scotland; cocoons of *Diprion*, probably *D. similis*, on rose stock from France; *Emphytus cinctus* on fruit-tree stocks from France and on rose stocks from England, Holland and France; a leaf-miner on boxwood from England; *Othius fulvipennis*, F., among evergreens from England; *Lepidosaphes ulmi* on boxwood from Holland; *Pieris* (*Pontia*) *rapae*, L., on rose stock from France; soft scale on boxwood from Holland; *Stenolophus skrimshiranus*, Schrank, among evergreens from England; woolly aphis [*Eriosoma lanigerum*] on apple roots from France; and Coleopterous larva in soil around rhododendrons from Holland.

The inspection of apiaries was continued and records are given of the occurrence of European foul-brood and American foul-brood in the State.

Cydia (*Laspeyresia*) *molesta*, Busck (oriental peach moth) was recorded from Connecticut in the report for 1917 [see this *Review*, Ser. A., vi, p. 456], and as a result of scouting throughout the State, larvae were found only in the one locality in which they were discovered in 1917, though twig injury that might be due either to this pest or to *Anarsia lineatella* (peach-twig borer) was found in each of the four southern or shore counties. The information concerning the life-history, habits and remedial measures against this moth have already been noticed [see this *Review*, Ser. A., vi, p. 373, and vii, p. 254]. *Anarsia lineatella*, Z. (peach twig-borer) has been discovered during these investigations to occur in Connecticut to an extent not previously realised, being more abundant along the coast than inland. In California, where extensive tests have been made, it is found that *A. lineatella* may be controlled by spraying with lime-sulphur or miscible oils just after the buds begin to swell, and this treatment may be continued until the first blossoms appear. *Pyrausta nubilalis*, Hbn. (European corn borer) had not, at the time of writing this report, yet appeared in Connecticut [see however this *Review*, Ser. A, vii, p. 284], but quarantine regulations have been issued against it. *Cerotoma trifurcata*, Forst. (bean leaf beetle) was recorded in 1918, for the first time in many years, as injuring beans in Connecticut. In cases of severe infestation 1 oz. lead-arsenate paste or ½ oz. dry powder in 1 U.S. gal. water should be sprayed on the plants, but care must be taken not to spray the beans if nearly ready for harvest. *Monophadnus* (*Monophadnoides*) *rubi*, Harr. (raspberry sawfly) has been collected

in many localities and probably occurs throughout the State. In a few cases raspberry fields were very badly damaged. The eggs are laid on the under-side of the leaves and hatch in 7 to 10 days, the young larvae at first eating only the epidermal layer and later destroying the entire leaf. After feeding for about 10 days they become mature and enter the ground, where they remain in pupal cells from June until the following spring, though they do not actually transform into pupae until March or April. The true pupal stage lasts only a few days and the adults emerge in May. It is essential for successful control to discover the presence of the insects in time, as the feeding period is short and the bushes may be stripped during May before the larvae are observed. The presence of the eggs can be detected by the yellowing of the tissue above the spots where they are deposited. Fresh hellebore dusted on the wet leaves or 1 oz. in 2 U.S. gals. water sprayed on the leaves when dry is an effective poison, or 2 lb. lead-arsenate paste or 1 lb. dry powder to 50 U.S. gals. water may be substituted. This should be applied soon after the plants bloom, or even before, to prevent defoliation. *Macronoctua onusta*, Grote (iris root-borer) has from time to time been reported in Connecticut and in 1918 caused damage in several localities. The life-history of this moth is not apparently very well known; it seems probable that the adults emerge and oviposit in the autumn, the eggs hatching in the following spring. It has been suggested that the iris leaves should be removed and burned, or the beds burned over in spring to destroy the eggs, but more definite knowledge of the life-history is required before remedial measures can be undertaken with any hope of success.

The insects attacking the potato crop have already been dealt with [see preceding paper]. In orchards the false red-bug [*Lygidea mendax*, Reut.] caused damage in some localities. The squash bug [*Anasa tristis*] was present in usual numbers; the elm leaf beetle [*Galerucella luteola*] is apparently increasing, and tussock moths [*Hemerocampa*] were abundant on fruit and shade-trees throughout the State.

Miscellaneous insects include *Macrodactylus subspinosus*, F. (rose chafer), which was somewhat less troublesome than in 1917, though it did considerable damage. *Bucculatrix canadensisella*, Chamb. (birch-leaf skeletoniser) has not been noticeable in Connecticut for the last 5 or 6 years, but in 1918 the larvae were observed in New Haven feeding upon the leaves of paper birch; it is expected that this moth will increase in abundance for the next few years, and all valuable shade-trees should be sprayed with lead arsenate to preserve their foliage. *Tortrix albicomana*, Clem., has been very abundant on rose bushes in some localities, the larvae tying together nearly all the leaves during May. *Heterocampa guttivitta*, Wlk., which was well distributed in 1917, was even more abundant in 1918, attacking maple, beach and birch. *Malacosoma americana* (tent caterpillar), after being abundant in 1913, 1914 and 1915, gradually decreased in numbers and was almost entirely absent in 1918. It will probably be abundant again in a few years. *Diarthronomyia hypogaea*, Lw. (chrysanthemum gall midge) is found in many greenhouses, the larvae forming galls on the leaf, flower sepal or shoot. Several generations may occur in a season. Thorough spraying every few days with nicotine sulphate solution (1 : 500) and soap is said to kill the emerging adults and many of the eggs. Further tests with remedial measures

are being undertaken. The large European Carabid beetle, *Calosoma sycophanta*, has been introduced into the State to destroy gipsy moth caterpillars, and appears to have become established and well distributed. *Saperda concolor*, Lec., var. *unicolor*, Joutel, has long been known as a borer in the small stems and branches of poplar and certain willows. The eggs of this beetle are laid in May in an incision in the bark; the larvae at first eat out a cavity under the bark and then construct a transverse tunnel, partially girdling the twig or branch, galls frequently forming at the injured points. There is only one generation in a year, the insect pupating and wintering in the burrows inside the twigs. A Phycitid moth, *Tetralopha robustella*, Z., was observed in October feeding on white pine. The larvae live in silken tubes extending through a globular mass formed of excrement. The life-history has not been worked out.

BRITTON (W. E.), DAVIS (I. W.) & ASHWORTH (J. T.). **Suppressing the Gipsy and Brown-tail Moths.**—*18th Rept. Connecticut State Entomologist for 1918, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 211, 1919, pp. 272–290, 1 fig. [Received 5th June 1919.]

The work of previous years has been continued [see this *Review*, Ser. A, vi, p. 458], except that on account of scarcity of labour it has been found necessary to rely more upon spraying and to curtail somewhat the scouting operations. During the year, seven new towns have been found slightly infested and a map of the State shows the areas infested by the gipsy moth [*Porthetria dispar*] and the brown-tail moth [*Nygmia phaeorrhoea*] and the areas quarantined on account of these infestations. The details of work in various towns are given and are summarised in a table. The brown-tail moth has been remarkably scarce during the past year, so that control measures have been unnecessary. An appeal is made for further appropriations for future work. It is pointed out that extermination of these pests is extremely improbable, if not impossible, with the present scale of appropriations, and that the successful work already accomplished would not have been possible without the hearty co-operation of the Federal Bureau of Entomology, which has expended in Connecticut each year an amount approximating to that expended by the State. It is needless to remark that the whole of the State would soon become thickly infested if provision were not made for holding the pests in check.

BRITTON (W. E.) & ZAPPE (M. P.). **Record of Treatments in an Attempt to control the Striped Cucumber Beetle, *Diabrotica vittata*, Fabr.**—*18th Rept. Connecticut State Entomologist for 1918, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 211, 1919, pp. 290-292. [Received 5th June 1919.]

Treatments in continuation of the tests made in previous years [see this *Review*, Ser. A, vi, p. 459] are summarised in a table; of the substances tested the following were effective in controlling *Diabrotica vittata*, F., and are given in the order of their effectiveness. Lead arsenate and powdered sulphur in equal parts dusted on both sides of the leaves caused no injury and very few beetles were found after treatment. Lead arsenate alone was fairly effective. Dry Bordeaux mixture, where it did not wash off, seemed to prevent injury by the

beetles, presumably acting as a repellent. Gypsum and ground limestone were less effective owing to being less adherent than finer and lighter powders. Air-slaked lime was effective, but caused some scorching of the leaves. Fish-oil and sawdust mixed together and sprinkled on the ground around the plants seemed to repel the beetles until the plants were out of danger. All dry powders are best applied when the foliage is wet.

BRITTON (W. E.) & ZAPPE (M. P.). **Tests of Sprays to control the Potato Aphid.**—*18th Rept. Connecticut State Entomologist for 1918, Conn. Agric. Expt. Sta., New Haven,* Bull. no. 211, 1919, pp. 294–297. [Received 5th June 1919.]

The difficulty of using soap in a nicotine solution in combination with arsenical poisons, on account of its liability to unite with the arsenate and injure the plant tissues, has led the authors to make tests with several spraying materials, using potato plants infested with Aphids for the experiments. Blackleaf 40, with sufficient soap to cause suds to appear when the mixture is shaken, killed a large percentage of Aphids when sprayed upon them. Common salt and water, commercial lime-sulphur, both with water and combined with nicotine solution, nicotine solution and molasses, were all tried with very little success, though none of them injured the plants. Casein, 1·5 grams, with quicklime, 3·5 grams, mixed and added at the rate of 4 oz. to 50 U.S. gals. of Blackleaf 40 and lead arsenate spray, was of questionable value as a spreader and did not apparently render the nicotine solution any more effective in killing Aphids. Nicotine oleate alone, with soap bark [Saponaria bark] and with glycerine killed many Aphids, but did not seem any more effective than Blackleaf 40 and soap. The best formula for kerosene emulsion proved to be 3 U.S. gals. kerosene, 4 cakes soap (about 40 oz.) in enough water to make 50 U.S. gals. spray. This mixture was very effective in killing Aphids. Nicotine solution and soap at current prices were more than twice as expensive besides being difficult to obtain, but required less labour to prepare.

ZAPPE (M. P.). **Life History and Development of the Greenhouse Cockroach,** *Pycnoscelus surinamensis,* **L.**—*18th Rept. Connecticut State Entomologist for 1918, Conn. Agric. Expt. Sta., New Haven,* Bull. no. 211, 1919, pp. 311–313. [Received 5th June 1919.]

These further studies on *Pycnoscelus surinamensis,* L. (greenhouse cockroach) [see this *Review*, Ser. A, vi, p. 460] deal with the immature stages and life-history. This insect evidently requires a hot, moist atmosphere for development, and shows a decided preference for greenhouses where the temperature is between 70° and 80° F. during the day and never lower than 60° at night. In the laboratory, at a temperature of 36° to 40° F., 95 per cent. died within a week and a temperature of 1° F. for 10 minutes proved fatal to them all. Individuals kept in test-tubes in dry sand or in dry boxes also died in a few days, though the presence of a small quantity of moisture was sufficient to keep them alive. No natural enemies have been observed in Connecticut with the exception of a mite. *P. surinamensis* undergoes six moults from the egg to the winged stage, the average length of

time taken being 7½ months. As from 50 to 100 days are required after maturity is reached before oviposition begins, the total time from one generation to another is approximately 10 months.

ZAPPE (M. P.). **Occurrence of the European House Cricket in Connecticut** (*Gryllus domesticus*, **L.**).—*18th Rept. Connecticut State Entomologist for 1918, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 211, 1919, pp. 313-316. [Received 5th June 1919.]

A case is recorded of a house in Connecticut, the attics of which were infested with *Gryllus domesticus*, L. (European house cricket), which attacked the rafters and boarding, clothing and any food they could reach. Two kinds of poison-bait were tried; the first consisted of ½ lb. potato flour, ½ lb. borax and one mashed ripe banana, all mixed with enough water to make a thin paste; the second was 1 tablet of bichloride of mercury dissolved in ½ cup of water, to which was added a cupful of flour and the chopped skin of a banana. When the house was visited two days later the majority of the crickets were dead, and as all the bait was eaten it was impossible to tell which was the more effective. The treatment was continued for another 9 days, after which the crickets were reported to have all disappeared.

KELLY (E. O. G.) & WILSON (T. S.). **Controlling the Garden Webworm in Alfalfa Fields.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 944, August 1918, 7 pp., 3 figs. [Received 10th June 1919.]

The bulk of the information for combating *Loxostege similalis* contained in this bulletin has previously been noticed [see this *Review*, Ser. A, v, p. 397]. The use of brush drags is advocated after the cutting of infested fields. Such a drag can be easily made by attaching short tough branches of trees to one side of a strong pole, 10 or 12 feet long, to the other side of which a team can be harnessed. A large field may be treated in this way in a short time and can be dragged twice without injury to the lucerne plants.

CHITTENDEN (F. H.). **Control of the Onion Thrips** (*Thrips tabaci*, **Lind.**).—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1007, 16 pp., 11 figs. [Received 10th June 1919.]

Thrips tabaci, Lind. (onion thrips) is the most serious menace to the onion-growing industry in the United States, causing a loss of some £450,000 annually, while the total damage by this species, which also attacks cabbage, cauliflower, cucumber, melon and many vegetable crops, amounts to about £600,000 annually. As this thrips breeds upon a large variety of weeds, clean farming and proper crop rotation help to keep it in check. Directions are given for spraying with nicotine sulphate [see this *Review*, Ser. A, v, p. 186], with illustrations of the apparatus most effective under various conditions.

KYLE (C. H.). **Shuck Protection for Ear Corn.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 708, 18th September 1918, 16 pp., 3 figs. [Received 10th June 1919.]

Details are given of investigations to determine the most important facts regarding the merits of shucks as a means of preventing damage

to maize in the ear by weevils and other Coleopterous pests of stored grain. The results obtained confirm the conclusions already arrived at on this subject and justify the recommendations previously given [see this *Review*, Ser. A, vii, p. 3].

BECKER (G. G.). **Control of the Round-headed Apple-tree Borer.**—*Univ. Arkansas Agric. Expt. Sta., Fayetteville*, Circ. no. 42, July 1918, 4 pp., 2 figs. [Received 10th June 1919.]

The information contained in this circular concerning *Saperda candida*, F. (round-headed apple-tree borer) has previously been noticed [see this *Review*, Ser. A, vi, p. 447].

UVAROV (B. P.). **Обзоръ вредителей сельскохозяйственныхъ растенiй Тифлисской и Эриванской губернiй.** [Review of Agricultural Pests of the Tiflis and Erivan Governments for the Year 1916–1917.] **«Тифлисское Земское Бюро борьбы съ Вредителями сельскаго хозяйства.»** [*Tiflis Bureau for Control of Agricultural Pests*], 58 pp., 1 plate, 1 map. [Received 9th June 1919.]

The list of the insect pests here given comprises :—17 Arachnoidea, 10 Orthoptera, 84 Rhynchota, 61 Lepidoptera, 53 Coleoptera, 13 Diptera, and 16 Hymenoptera.

The characteristics of the different localities are described, with the pests occurring in them. Lists of the pests arranged according to their food-plants, as well as alphabetically under their scientific names, are appended.

The pests recorded include Rhynchota :—*Stephanitis pyri*, F., which is widely distributed and causes most damage in dry districts, being especially numerous in April. *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm. (woolly aphis) is one of the most serious pest in the Caucasus; the damage caused varies in different districts, damp localities suffering most. *Pterochloroides persicae*, Cholodk., is found everywhere on peaches, ultimately causing the death of the trees in about 10 to 15 years ; the chief damage is done in hot and dry districts. Almonds and *Prunus divaricata* are also attacked. *Myzodes tabaci*, Mordv., is a very serious tobacco pest, and much reduces the value of the crop. *Brachycolus noxius*, Mordv., *Macrosiphum granarium* and *Aphis maidis* are the chief Aphid pests of cereals. *Aspidiotus ostreaeformis*, Curt., infesting pear and apple trees, is one of the most important Coccids.

Lepidopterous pests include :—*Orgyia antiqua*, Hb., which infests apples and has two generations a year, hibernation occurring in the egg-stage of the second generation. *Nygmia phaeorrhoea* occurs chiefly on *Mespilus oxyacantha*, more rarely on apples, pears and plums. *Pyrausta nubilalis*, Hb., causes great damage to maize and has two generations in the Caucasus. *Cydia* (*Carpocapsa*) *pomonella*, L., is chiefly found in the higher districts attacking apples, plums, pears, apricots, quinces, pomegranates, peaches and cherries, but does not appear in great numbers probably owing to the activity of parasites and fungus diseases. *Hyponomeuta malinellus*, Z., and *H. variabilis*, Z., which may become very serious pests, are unequally distributed in the different districts, depending on climatic conditions

Tischeria complanella, Hb., multiplied in 1917 to such an extent as to cause a general infestation of oak trees. It also attacks chestnuts. There are 3 generations, the caterpillars of the third generation hibernating in the larval mines.

Coleoptera include: *Hypera (Phytonomus) variabilis*, Hbst., which is very destructive to lucerne, the adult weevils appearing at the beginning of May. *Anthonomus pomorum*, L., was especially destructive in 1916, when three-fourths of the apple crop was injured. The numbers have since considerably decreased owing to the presence of numerous parasites of this weevil. *Polyphylla olivieri*, Lap., caused very serious damage to roots of vines and apple trees, especially to seedlings. Mulberry trees also suffered very much, but whether from *P. olivieri* or *P. adspersa* has not been ascertained. *Epicometis (Tropinota) hirta*, Poda, *E. (T.) senicula*, Men., and *E. (T.) suturalis*, Rttr., are not very serious pests of fruit trees, as the time of their maximum appearance is not until blossoming is over. Several species of *Anisoplia* are recorded, but the damage to grain is comparatively slight. A table is given of the seasonal occurrence and numbers collected of each species in each district.

Diptera include: *Chlorops taeniopus*, Meig., which caused serious damage to wheat and oats in 1916.

Among Hymenopterous pests *Cephus pygmaeus*, L., has a wide distribution, but its numbers are checked by its parasite, *Collyria* sp. It appears as early as April and is chiefly found on wheat.

UVAROV (B. P.). **Показательныя мѣропріятія по борьбѣ съ вредителями и болѣзнями растеній въ 1917 году.** [Demonstrations in Control of Pests and Diseases of Plants in 1917.]—**«Извѣстія Т.-Э.-К. Бюро борьбы съ вредителями сельскаго хозяйства.»** [*Bull. of the Bureau for Control of Agricultural Pests*], *Tiflis*, no. 3, September 1917, 46 pp. [Received 9th June 1919.]

Demonstrations of the usual remedial measures for garden pests were carried out in various districts of the Caucasus by the staff of the Bureau. *Hyponomeuta malinellus*, Z., and *H. variabilis*, Z., were very numerous during 1916, but their numbers were greatly diminished in 1917 by spraying with Bordeaux mixture and Paris green.

ARKHANGELSKY (P. P.). **Опыты по борьбѣ съ кровяной и другими тлями.** [Observations on the Control of *Eriosoma lanigerum*, Hausm., and other Aphids.]—**«Извѣстія Т.-Э.-Н. Бюро борьбы съ вредителями сельскаго хозяйства.»** [*Bull. of the Bureau for Control of Agricultural Pests*], *Tiflis*, no. 5, October 1917, 23 pp. [Received 9th June 1919.]

Experiments made in Transcaucasia to ascertain the efficacy of various insecticides as a remedial measure for Aphids are described.

A mixture of naptha-lysol and cresol as prepared by Nobel Bros. as an insecticide is of no use against *Eriosoma lanigerum*, Hausm., if made weaker than a 2½ per cent. solution, but if used stronger than 3½ per cent. it is injurious to apple foliage. For *Hyalopterus arundinis* (*pruni* F.) on peaches the only effective solution was 2½ per cent., but

this scorched the leaves to such an extent that its use is not advocated. This mixture is most useful for *Aphis pomi*, DeG., for which it may be used at 1½ to 2 per cent. strength, also for *Pterochloroides persicae*, Chol., as a 3½ per cent. solution. This strength does not damage peaches, as these Aphids congregate on the bark.

Kerosene-lime emulsion proved the most effective for *E. lanigerum* used at the strength of 13½–18 lb. of kerosene to 9–12 oz. of unslaked lime and 27 gals. of water. A weaker emulsion is sufficient to kill *Hyalopterus arundinis*. Crude oil is not recommended, as although it will kill the Aphids it has too many other disadvantages.

Tables are given of the various experiments made.

UVAROV (B. P.). **Какъ бороться съ кровяной тлей.** [The Control of *Eriosoma lanigerum*, Hausm.]—**«Общедоступныя сообщенія о вредителяхъ и болѣзняхъ культурныхъ растеніи.»** [*Popular Information of Pests and Diseases of Cultivated Plants*], *Tiflis*, no. 6, December 1917, 7 pp., 4 figs. [Received 9th June 1919.]

The woolly aphis, *Eriosoma lanigerum*, Hausm., is described and the usual remedial measures are advocated.

UVAROV (B. P.). **Матеріалы къ познанію прямокрылыхъ Кавказа и сопредѣльныхъ странъ.** [Contributions to the Knowledge of Orthoptera of the Caucasus and adjoining Regions.] **I. Прямокрылыя, собранныя П. В. Нестеровымъ во время путешествія вдоль персидско-турецкои границы.** [1. Orthoptera collected by P. V. Nesterov on his Journey along the Perso-Turkish frontier.]—Separate, dated August 1916, from **«Извѣстія Кавказскаго Музея.»** [*Bull. of the Caucasian Museum*], *Tiflis*, x, 14 pp., 9 figs. [Received 9th June 1919.]

A list is given of Orthoptera of the Caucasus, including *Kurdia nesterovi*, gen. et sp. n., *Drymadusa curvicercis*, sp. n., *Olynthoscelis zebra*, sp. n., and *O. kurda*, sp. n., all from Kurdistan, which are described in Latin.

UVAROV (B. P.). **Матеріалы къ познанію прямокрылыхъ Каваказа и сопредѣльныхъ странъ.** [Contributions to the Knowledge of Orthoptera of the Caucasus and adjoining Regions.] **II. Діагнозы новыхъ видовъ и расъ изъ коллекцій Кавказскаго Музея.** [2. Determination of new Species and Subspecies in the Collection of the Caucasus Museum.]—Separate from **«Извѣстія Кавказскаго Музея.»** [*Bull. of the Caucasian Museum*], xi, 18 pp., 15 figs. [Received 9th June 1919.]

The following new species and subspecies of Orthoptera are described in Latin : *Arcyptera flavicosta transcaucasica*, *Celes variabilis carbonaria*, *Podisma lezgina*, *Isophya poltoratskii*, *Paradrymadusa pastuchovi* and *P. expugnata* from Transcaucasia ; *P. bocquilloni*, *P. persa* and *Platycleis persica* from Persia ; *P. iljinskii* from Transcaucasia ; *P. daghestanica*, from Daghestan ; *P. capitata* from Persia ; and *Olynthoscelis kerketa* from Circassia.

UVAROV (B. P.). **Прямокрылыя** (Orthoptera genuina) **собранныя Урмiнской экспедицiей 1916 года.** [Orthoptera collected on the Urmi Expedition in 1916.]—Separate, dated November 1918, from **«Извѣстiя Кавказскаго Музея»** [*Bull. of the Caucasian Museum*], xii, 15 pp., 17 figs. [Received 9th June 1919.]

Among the Orthoptera collected the following new species are described in Latin: *Tmethis saussurei* from Transcaucasia, Persia, Turkish Armenia and Kurdistan; *T. zaitzevi*, from Transcaucasia; *Nocarodes voronovi*, from Transcaucasia; *N. rimansonae*, from Transcaucasia; and *N. schelkovnikovi*, from Persia.

Keys to the species of *Tmethis* and *Nocarodes* are given in Latin.

UVAROV (B. P.). **О русскихъ формахъ рода** *Acrida*, L. (Orthoptera, Acridiodea). [On Russian Forms of the Genus *Acrida*, L.]—Separate from **«Русское Энтомологическое Обозрѣнiе»** [*Russian Review of Entomology*], xvi, 1916, nos. 1–2, 6 pp., 4 figs. [Received 9th June 1919.]

The following are described in Latin: *Acrida robusta*, sp. n., and *A. turrita deserti*, subsp. n., from Transcaucasia. A key is given to the species of the genus *Acrida* in Russian.

ARKHANGELSKY (N. N.). **Описанiе личинки** *Polyphylla olivieri*, Lap. (Coleoptera, Scarabaeidae). [Description of the Larva of *Polyphylla olivieri*, Lap.]—Separate from **«Извѣстiя Кавказскаго Музея.»** [*Bull. of the Caucasian Museum*], xi, 6 pp., 5 figs. [Received 9th June 1919.]

The larva of the Melolonthid beetle, *Polyphylla olivieri*, Lap., is described from specimens collected in the Tiflis-Erivan district. It is compared with those of *P. adspersa*, Mot., and *P. alba*, Pall., which are also found in the Caucasus, but less frequently.

ZAITZEV (Ph.). **Закавказская дынная муха**-*Carpomyia* (*Myiopardalis*) *caucasica*, sp. n. (Diptera, Trypetidae). [The Transcaucasian Melon Fly.]—Separate from **«Зап. Научно-прикл. Отдѣловъ Тифл. Бот. Сада.»** [*Scientific Conclusions Dept. Tiflis Bot. Gardens*], no. 1, 1919, pp. 4, 1 fig. [Received 9th June 1919.]

Carpomyia (*Myiopardalis*) *caucasica*, sp. n., found infesting the fruit of melons in the Governments of Elisavetpol and Baku, is described. An abstract in English is appended.

PRINZ (J.). **Къ бiологiи закавказской дынной мухи.** [Biology of the Melon Fly, *Carpomyia caucasica*, Zaitz.]—Separate from **«Зап. Научно-прикл. Отдѣловъ Тифл. Бот. Сада.»** [*Scientific Conclusions Dept. Tiflis Bot. Gardens*], no. 1, 1919, 7 pp. [Received 9th June 1919.]

The fly discovered by the author on melons has been identified as a new Trypetid, *Carpomyia caucasica* [see preceding paper]. The adult flies were observed on the wing among melons from about 10 to 12 a.m. The author was unable to detect the act of oviposition, but believes that the eggs are laid singly under the skin of the rind. The

larvae on hatching burrow their way to the centre of the fruit, where pupation takes place in July. If the melon is not very large and the pulp is soft enough, they bore their way out again and pupate about ½ inch under the surface of the soil or under the remains of plants. Pupation may also take place halfway between the centre and circumference of the melon. Should the larvae not succeed in emerging from the melon, the fruit does not deteriorate much in value, but once an exit is made allowing the entrance of bacteria, it rots rapidly. The thin-skinned early-ripening summer varieties suffer most, the thick-skinned winter ones being least affected. There are two generations, one in July, the other in August.

Nothing is so far known of the various stages. In 1917 as much as 80 per cent. of the melons were injured by this fly, but in 1918 it was not seen at all, probably owing to low temperature during the spring.

The only remedial measure so far adopted is to protect the fruits from oviposition by covering them with earth, but as this deteriorates the quality of the fruit, it is not advocated.

Cucumis citrullus (water melon) is also attacked by this fly, but to a less extent.

An abstract in German is appended.

CARDIN (P. G.). **El Trips de los Laureles, *Gynaikothrips uzeli*, Zimmermann.**—*Mem. Soc. Cubana Hist. Nat. "Felipe Poey," Havana*, i, no. 6, November and December 1915, pp. 282–284. [Received 6th June 1919.]

Gynaikothrips uzeli, Zimm., was first observed in Cuba in 1887 and is now common on many species of *Ficus*, especially *F. retusa*, *F. benjamina*, and *F. nitida*.

CARDIN (P. G.). **Una Plaga de los Citrus nueva en Cuba.**—*Mem. Soc. Cubana Hist. Nat. "Felipe Poey," Havana*, ii, no. 1, January and February 1916, pp. 39–42.

The life-history and damage occasioned by *Aleurocanthus woglumi*, Quaint., on citrus in Cuba are described [see this *Review*, Ser. A, vi, p. 392]. A certain measure of control is exercised in the Island by fungus diseases, the chief of which is perhaps the species infesting it in Florida [see this *Review*, Ser. A, iii, p. 651], and another that appears to be *Aschersonia aleurodis*.

CARDIN (P. G.). **Notas Entomológicas.**—*Mem. Soc. Cubana Hist. Nat. "Felipe Poey," Havana*, iii, nos. 2 and 3, 1917–1918, pp. 53–61.

The froghopper, *Monecphora bicincta*, Say, has increased to alarming numbers in certain parts of Cuba [see this *Review*, Ser. A, vi, p. 392], and has completely devastated large areas bearing the grass, *Panicum numidianum*, other food-plants being sugar-cane (*Saccharum officinarum*), Guinea grass (*Panicum maximum*), *Andropogon muricatus*, *Sorghum halepense* and other Gramineae.

Injurious species of thrips in Cuba include *Diceratothrips picticornis*, Hood, in galls of the fruit of *Eugenia* sp. ; *Frankliniella cephalica*, Crawf., in flowers of *Citrus* and other plants ; *F. insularis*, Frankl., in *Citrus* flowers ; *F. williamsi*, Hood, on sugar-cane ; *Gynaikothrips*

uzeli, Zim.; *Haplothrips gowdeyi*, Frankl., in flowers of *Melanthera deltoidea*, in tobacco seeds and in galleries of *Agromyza* sp. on tomato leaves; *Heliothrips haemorrhoidalis*, Bch., on leaves of *Persea gratissima* and mango; *Hoplandrothrips affinis*, Hood, and *Podothrips semiflavus*, Hood, on sugar-cane at the base of the leaves; *Heliothrips* (*Selenothrips*) *rubrocinctus*, Giard, on leaves of *Mangifera indica*; *Thrips abdominalis*, Crawf., in flowers of *Bidens leucantha*; *Thrips tabaci*, Lind., on leaves of *Allium cepa* and in flowers of Cruciferae; and a new species of *Zygothrips* at the base of sugar-cane leaves.

Wood damaged by *Cryptotermes*, should be treated with carbon bisulphide or bichloride of mercury 20 : 1,000. Other remedies are arsenic acid distributed about cellars, which is taken on to the feet of the insects and thus poisons them; for wooden objects, books, etc., 1,000 cc. of methylated spirit, bichloride of mercury 20 grms., phenic acid 25 cc., with sufficient shellac to produce a slightly adhesive liquid, should be used. This should be brushed lightly over the covers of books. Other injurious termites are *Eutermes* sp., in decayed wood, and a new species of *Calotermes*, taken in the decayed trunk of *Persea gratissima*, together with *Arrhinotermes simplex*, Hagen.

JOHNSTON (J. R.). **Algunos Hongos Entomogenos de Cuba.** [Some Entomogenous Fungi of Cuba.]—*Mem. Soc. Cubana Hist. Nat. "Felipe Poey," Havana*, iii, nos. 2 and 3, 1917–1918, pp. 61–82, 2 plates.

The fungi of Cuba that naturally infest injurious insects and exercise some measure of control over them include: *Aegerita webberi*, on *Aleurothrixus* (*Aleurodes*) *howardi*; *Aschersonia aleurodis*, on whiteflies; *A. cubensis*, on *Saissetia hemisphaerica*; *A. goldiana*, on whiteflies on *Citrus*; *A. turbinata*, on undetermined species of *Lecanium*; *A. viridans*, on whiteflies; *Aspergillus flavus*, which apparently keeps in check the sugar-cane mealy-bug [*Pseudococcus sacchari*]; *Botrytis rileyi*, on the larvae of various Noctuids; *Cephalosporium lecanii*, on *Saissetia hemisphaerica* and *Coccus mangiferae*; *Cordyceps barberi*, on the larvae of *Diatraea saccharalis*; *C. dipterigena*, on the common house-fly [*Musca domestica*]; *C. sphecophila*, on *Polistes lineatus*; *Empusa muscae*, on a small Dolichopodid fly; *Entomophthora sphaerosperma*, on a species of *Heterocoris*; *Metarrhizium anisopliae*, on the adult of an Asilid, *Plesiomma* sp., and also on a wireworm; *Myriangium duriaei*, on *Lepidosaphes beckii* (*Mytilaspis citricola*) and *Chionaspis citri*; *Sporotrichum globuliferum*, on *Xyleborus* sp. and *Metamasius hemipterus*; *Spicaria aleurodis*, on *Aleurodes variabilis*; *Torrubiella lecanii*, on or accompaning *Cephalosporium lecanii* on *Saissetia hemisphaerica*; and *Verticillium heterocladum*, on *Aleurodes* sp.

MERCET (R. G.). **Revisión de los Signiforinos de España.**—*Revista R. Acad. Ciencias Exactas, Físicas y Naturales, Madrid*, xvi, no. 4, October 1917, pp. 160–170.

The Encyrtid subfamily SIGNIPHORINAE is revised in accordance with new material that has recently been collected. A key to the genera is given, and *Thysanus ater*, Wlk., is redescribed. This species is abundant in central Spain during July and August on the branches

of various pines. A key is also given to the Spanish species of *Signiphora* with notes on *S. (Matritia) conjugalis*, Mercet, which is probably parasitic upon some Coccid, like other members of the genus, and is found on pines throughout the south and centre of Spain. *S. (M.) simillima*, sp. n., taken on branches of *Pinus silvestris* in July 1917 is described.

MIYAKE (T.). **Mikanbai ni kwansuru Chosa.** [Studies on the Orange-Fly.]—*Byokin-Gaichu Iho* [*Bulletin of Plant Pathology and Injurious Insects*], *Imperial Agricultural Bureau, Tokyo*, no. 5, 31st March 1919, 47 pp., 4 plates.

Nearly the same results as already recorded [see this *Review*, Ser. A, vii, p. 238] are given; the author's view that Japan is the original home of this fruit-fly (*Dacus tsuneonis*) is withdrawn.

OJIMA (G.). **Mikan-Mibai.** [Orange Fly.]—*Byochugai-Zasshi* [*Journal of Plant Protection*], *Tokyo*, vi, no. 5, 5th May 1919, pp. 319-344, 1 plate.

The author further describes the morphology and life-history of, and control measures for, the Japanese orange-fly (*Dacus tsuneonis*, Miyake). Among the new data added are the fact that out of 1,000 pupae buried under the soil about 67 per cent. emerged, the rest being found to be dead. Moles prey extensively upon the pupae of this fly, so that in this respect they should be looked upon as beneficial.

NAGANO (K.) & YAMADA (Y.). **Budo no Gaichu Tobi-iro-toraga, *Seudyra subflava*, no Seikatsushi ni tsukite.** [On the Life-history of the Vine-infesting Moth, *Seudyra subflava*.]—*Konchusekai* [*Insect World*], *Gifu*, xxiii, no. 5, 15th May 1919, pp. 173-178, 4 plates.

The authors agree with the transfer by Hampson of the moth, *Seudyra subflava*, Moore, from the AGARISTIDAE to the ACRONYCTINAE. The total life-cycle is not yet known. It is probably a two-brooded insect. In Japan the caterpillars appear in May and June, the moths in July, the caterpillars of the second generation in August, and the moths in the following May. In Manchuria, the caterpillars appear in June and July and the moths in August. This species attacks the leaves of vine and ivy, and in Manchuria does no small damage in vineyards, especially to young foliage.

TULLGREN (A.). **Om ett för Odlingen av Korgpil viktigt Skadedjur, *Euura laeta*, Zadd.** [*Cryptocampus laetus*, an Insect injurious to the cultivation of Basket Willows.]—*Meddelande från Centralanstalten för Försöksväsendet på Jordbruksområdet*, no. 180; *Entomologiska Afdelningen*, no. 31, 1919, 12 pp., 9 figs. [With a summary in German.]

The occurrence of the sawfly, *Cryptocampus (Euura) laetus*, Zadd., is reported from Sweden, where a plantation of *Salix viminalis* (basket willow) was seriously injured. The galls produced give rise to small wounds in the rods, rendering them useless for the finer grades of basket work and apt to be easily broken. The larva is described

and notes on the development and life-history are given. The biology of *C. laetus* is very similar to that of the closely-related *C.* (*E.*) *saliceti*, Fall., but the gall-formations differ widely, those of *C. laetus* being always under the buds, while those of *C. saliceti* include the buds. The larvae of *C. laetus* hibernate in the pith of the rod stumps. For this reason it is advised that when the osiers are being harvested the stumps should be left of sufficient height to permit of their being shortened by 3½–4 inches in winter. The pieces cut off at this time must be burnt. As an alternative to this laborious method, it may be possible to destroy the hibernating larvae by painting the stumps with tar containing a proportion of arsenic.

KEMNER (N. A.). **Hallon- och Vinbärsglasvingarna (*Bembecia hylaeiformis*, Lasp., och *Sesia tipuliformis*, Cl.), två Skadejur på Bärbuskarna.** [The Raspberry Root Borer, *Pennisetia hylaeiformis*, and the Currant Borer, *Aegeria tipuliformis*, two Insects injurious to Fruit Bushes.]—*Meddelande från Centralanstalten för Försöksväsendet på Jordbruksområdet*, no. 181; *Entomologiska Avdelningen*, no. 32, 1919, 18 pp., 15 figs. [With a summary in German.]

In Sweden the moth, *Pennisetia hylaeiformis*, is crepuscular or nocturnal in habit and flies in July. The eggs are dropped on the ground around raspberry canes. On hatching the larvae attack the underground portions of the canes, and the entrance-holes may be found as deep as 4 inches beneath the surface of the ground. The larval mine is at first on the surface of the underground stem and often runs round it so that a gall is formed. The pupal mine, which is often prepared in autumn, is always made in an old stem. Up to the present this has been considered the sole form of injury, old canes that have lost their vigour being affected. Of far greater economic importance, however, is the earlier mine beneath the pupal mine, as this weakens or kills all the shoots higher up.

The larva is described, and the characters that differentiate it from allied species are given. A brief description is also given of the pupa. *P. hylaeiformis* appears to have one annual generation in Sweden. The only recognised insect enemy of this moth is an Ichneumonid, *Meresia arguta*, Wsml. A *Cordyceps* fungus infests the pupa.

Aegeria tipuliformis usually flies in July. There is one generation a year. The eggs are laid singly on the branches and the larvae first attack the thin top branches and then hibernate in the stems. The galleries always have black walls.

The attack results in the withering of the small twigs of the crown. Mines in older stems do not cause so much harm. Infested bushes bear scarcely any fruit and do not produce shoots.

CECCONI (G.). **Manuale di Entomologia Forestale.**—*Florence*, Fasc. 7, 1919, 64 pp., 69 figs. [Received 30th May 1919.]

The seventh part of this work [see this *Review*, Ser. A, v, p. 487] covering pp. 385–448 concludes the account of Coleopterous pests of forests and begins the description of carnivorous beetles, some of which are of considerable economic value.

GRANDI (G.). **Contributo alla Conoscenza degli Agaonini (Hymenoptera, Chalcididae) dell' America. Agaonini di Costarica.** [A Contribution to the Knowledge of the Agaoninae of America. Agaoninae of Costa Rica.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric. Portici*, xiii, 1919, pp. 15–56, 13 figs.

In this first contribution relating to American AGAONINAE, of which only six species have been hitherto known, the following six new species from Costa Rica are described and figured : *Blastophaga aguilari* from *Ficus lapathifolia* ; *B. estherae* from *F. costaricana* ; *B. tristani* and *B. silvestrii* from *F. padifolia* ; *B. tonduzi* from *F. hemsleyana* ; *B. jimenezi* from *F. jimenezi*. For the first-named the new sub-genus *Julianella* has been erected, and the other five are placed in the new sub-genus *Valentinella*.

LUTZ (A.) & DA COSTA LIMA (A.). **Contribuição para Estudo das Tripaneidas (Moscas de Frutas) brazileiras.** [A Contribution to the Study of Brazilian Trypetidae.]—*Mem. Inst. Oswaldo Cruz, Rio de Janeiro*, x, no. 1, 1918, pp. 4–16, 2 plates. [With a summary in English.] [Received 12th June 1919.]

The collections of fruit-flies in the Oswaldo Cruz Institute and in the Natural History Museum of S. Paulo are discussed and some new species and varieties are described. The most important is *Anastrepha fraterculus*, Wied., which occurs in Mexico, Cuba, Porto Rico, Peru, Brazil and Paraguay. It is very injurious to guava and peach, and also attacks *Passiflora quadrangularis* and *Diospyrus kaki*. This species is very variable and several forms described as new species are thought to be probably only varieties of it, *e.g.* :—*A. suspensa*, Lw., *A. ludens*, Lw., *A. hamata*, Lw., *A. integra*, Lw., *A. consobrina*, Lw., *A. pseudo-parallela*, Lw., *A. obliqua*, Macq., and perhaps *A. peruviana*, Towns., while even *A. parallela*, Wied., though apparently differing in size and venation, is connected by intermediate forms. The only specimen not connected with the others by intermediate forms is described under the name of *A. fenestrata* ; it is found in the Amazon region and may be either a new species or a rather aberrant variety.

A. serpentina, Wied., is another indigenous species ; it attacks *Mammea americana*, *Sapota achras*, *Lucuma cainito* and *Mimusops coriacea*. Of the genus *Hexachaeta* one species, *H. eximia*, Wied., was observed near Rio de Janeiro. The genus *Plagiotoma*, Lw., is discussed, and a key is given to the two known Brazilian species, *P. obliqua*, Lw., and *P. biseriata*, Lw., and to three others here described, *P. rudolphi*, *P. jonasi* and *P. trivittata*. The early stages of these flies are found in galls of Composites of the genus *Vernonia*. A list is given of the genus *Apyrgota* Hendel (1913), sub-family PYRGOTINAE, and a new species, *A. personata*, that might be mistaken for a *Trypeta*, is described. A list of species of the genus *Anastrepha* with the synonymy and literature is also appended.

BREZZI (M.). **Descoberta de uma nova Mosca das Fructas no Brazil.** [Discovery of a new Fruit-fly in Brazil.]—*Chacaras e Quintaes, S. Paulo*, xix, no. 5, May 1919, pp. 372–374, 2 figs.

The new Brazilian fruit-fly, *Anastrepha bistrigata* [see this *Review*, Ser. A, vii, p. 268] was taken from the fruits of " araca " [*Psidium*

araca]. A parasite, identified by Silvestri as *Biosteres brasiliensis*, may be an enemy either of this fruit-fly or of *A. fraterculus*, as these species occur together.

Algumas Pragas do Coqueiro. [Some Coconut Pests.]—*Chacaras e Quintaes, S. Paulo*, **xix**, no. 5, May 1919, p. 403, 1 fig.

Among coconut pests from the State of Maranhaõ, Brazil, the beetles, *Rhynchophorus palmarum* and *Mecistomela corallina*, and the butterfly, *Brassolis astyra*, have been identified.

UZEL (H.). **Ueber Krankheiten und Schädiger der Zucker-und Samenrübe in Böhmen in den Jahren 1916 und 1917.** [Diseases and Pests of Sugar Beet and Seed Beet in Bohemia in 1916 and 1917.]—*Zeitschr. f. Zuckerindustrie in Böhmen*, 1917–1918, pp. 228–233 and 423–430. (Abstracts in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 8, 15th December 1918, p. 339.)

Nematodes and a beetle, *Atomaria linearis*, were found in the earth clinging to sugar-beets that had been lifted. Seed-beet suffered chiefly, in 1917 especially, from the black aphis; the green aphis also occurred. The flowers were injured by various beetles, usually *Agriotes ustulatus*, and occasionally *Athous niger* and *A. vittatus*.

ZACHER (F.). **Ein für Deutschland neuer Gerstenschädling.** [A Barley Pest new to Germany.]—*Deutsche Landwirtschaftl. Presse, Berlin*, xlvi, no. 38, 10th May 1919, p. 275.

From pupae taken in August 1918 from ears of barley near Berlin a Chloropid fly, *Lasiosina cinctipes*, Meig., was bred. In this case the injury somewhat resembled that done by the second generation of *Oscinella frit* (frit-fly) to barley and oats, the larvae chiefly attacking the grains and pupating within the empty husks. Another Chloropid, *Elachiptera cornuta*, Fall., was observed on this occasion. This species does not appear to have been previously recorded in Germany.

BURKHARDT (F.). **Untersuchungen über die Bekämpfung des Kornkäfers (*Calandra granaria*, L.) mittels Cyanwasserstoff.** [Investigations on the Use of Hydrocyanic Acid Gas against *C. granaria*.]—*Centralbl. Bakt. Parasit. u. Infektionskr., IIte Abt., Jena*, xlix, no. 1–4, 22nd January 1919, pp. 77–91, 1 fig.

Laboratory tests with hydrocyanic acid gas made in order to ascertain its effects on *Calandra granaria* are described. The temperature was 60°–68° F. (16°–20° C.) and the humidity within the small gas chambers, consisting of glass bells, was 65–75 per cent. at first, increased by 4 or 5 per cent. when 1 volume of hydrocyanic acid gas per 100 volumes of air was present and by about 10 per cent. when 2 volumes of the gas were present. This increase was due to the steam produced during the generation of the gas. Under these conditions 1 volume of gas per cent. killed the weevils in 15 hours, while 2 volumes effected this result in 6 hours. Practical tests were made in a room of about 3,700 cub. feet space after paper had been pasted over cracks and other openings. As such sealing was not so complete as that obtainable in the laboratory it was necessary to use the higher strength of 2

volumes gas to ensure at least 0·5 per cent. being present. Unsheltered weevils were then killed in 15 hours, but those covered by a layer of grain, 10 inches or more in thickness, were more or less protected from the effects of the gas. As the majority of individuals are found at some depth or even within the grains of wheat, this fumigant is not of practical value in combating *C. granaria*.

OBERSTEIN (—.). **Ueber das Auftreten von *Thersilochus morionellus*, Holmgren, als natürlicher Feind des Rapsglanzkäfers (*Meligethes aeneus*, F.) in Schlesien.** [The Occurrence of *Thersilochus morionellus* as a Natural Enemy of *Meligethes aeneus* in Silesia.]—*Centralbl. Bakt., Parasit. u. Infektionskr., II^te Abt., Jena*, xlix, no. 1-4, 22nd January 1919, pp. 91–92.

In the spring of 1918 a field of rape in Silesia was very severely infested by a beetle, *Meligethes aeneus*, F., both the adults and larvae causing injury. An Ichneumonid parasite, *Thersilochus morionellus*, Holmgr., was also observed. This is the first record from Silesia of the occurrence of this beetle in a field of rape, which is remarkable, in view of the fact that in 1913 the Province produced one-quarter of the Prussian rape crop.

ENDERS (H. E.). **Dwarfing Effect of Attacks of Mites of the Genus *Eriophyes* upon Norway Maples.**—*Proc. Indiana Acad. Sci., Fort Wayne*, 1917, pp. 79–84, 4 figs.

Great numbers of a mite, a species of *Eriophyes*, infest maple leaves in Pennsylvania and are believed to be the cause of stunted growth. The infestation is spread over very large areas, indicating that the mite is probably distributed by birds.

As a remedial measure spraying the trees in winter with kerosene emulsion diluted with 5 to 7 parts of water is suggested, since it is probable that the mites hibernate in the buds.

ALLAN (C. W.). **Life History of the *Antheraea roylei* (Oak Emperor) Moth.**—*Jl. Bombay Nat. Hist. Soc., Bombay*, xxvi, no. 1, 20th December 1918, pp. 300–301.

As *Antheraea roylei* has three generations in the year and the caterpillars are easily reared in captivity, their food consisting of oak (*Quercus semiserrata*), it is suggested that this species might be valuable in sericulture, the silk produced being of good quality.

McLAINE (L. S.). **The European Corn Borer, *Pyrausta nubilalis*, Hbn.: a new and most dangerous Pest.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 5, May 1919, pp. 443–446, 3 figs.

In view of the recent outbreaks of *Pyrausta nubilalis* in the United States a general account of this moth is given, and a warning against its possible introduction into Canada is issued.

BALLOU (H. A.). **Chinch Bug Fungus.**—*Agric. News, Barbados*, xviii, no. 445, 17th May 1919, p. 154.

The fungus, *Sporotrichum globuliferum*, already known to attack *Blissus leucopterus* in Kansas, is now recorded from Antigua as infesting cotton-stainers [*Dysdercus*]. The artificial distribution of this fungus, which is easily cultivated on an artificial medium such as flour paste with the addition of a little meat extract, may be advisable under West Indian conditions, though it has not been successful against the chinch bug in Kansas.

SANDS (W. N.). **The Mahoe Cochon Tree in relation to Cotton Stainer Control in St. Vincent.**—*Agric. News, Barbados*, xviii, no. 445, 17th May 1919, pp. 154–155.

In the course of the campaign in St. Vincent against *Dysdercus delauneyi*, Leth. (cotton-stainer), investigations were made to ascertain the relation of this pest to the Mahoe Cochon tree (*Sterculia caribaea*).

It has been decided that destruction of these trees shall not be undertaken until it has been definitely proved that they enable the cotton-stainer to tide over the critical period from April to July in each year. It is not improbable that they act as a trap where the insects become infested by the fungus, *Sporotrichum globuliferum*.

G. E. **The Maize Stem Borer. A Pest on Maize (Idhra) and Juar (Idhra baidi).**—Leaflet from *Agricultural Directorate, Baghdad*, 15th November 1918, 1 p. [Received 18th June 1919.]

The damage caused by *Chilo simplex* all over Mesopotamia is so great that the cultivation of maize has been completely replaced by that of lukka (*Setaria italica*) or by the dwarf Arab maize. The borer attacks the stems and prevents grain formation.

The adult moth flies after dark and deposits eggs on the leaves. The caterpillar hatches in a week, commences feeding on the leaves and soon attacks the stem. The attacked shoots wither and dry up. Pupation takes place after a month in the stem, the moth appearing about a week later. In warm weather the life-cycle lasts about 6 weeks; during the cold season the caterpillars and pupae hibernate in the stumps and stubble until the appearance of the new crop.

All stumps should be ploughed up and burnt as soon as the maize has been reaped. Any withered shoots appearing in the new crop should be at once cut out and burnt.

RAMSBOTTOM (J. K.). **Experiments on the Control of Narcissus Eelworm in the Field.**—*Jl. R. Hortic. Soc., London*, xliv, May 1919, pp. 68–72, 1 fig., 1 plate.

Experiments were undertaken on a plot of land that had been planted with narcissus bulbs in 1915 and in which eelworm disease, caused by *Tylenchus devastatrix*, was so prevalent in the spring of 1917 that the cultivation of these bulbs was abandoned. An onion crop was planted, and though the seed germinated freely the young plants wholly disappeared owing to eelworm attack. The first series of experiments was concerned with the application of manures and proved that the treatment of infested ground with the fertilisers and

combinations of fertilisers experimented with cannot be depended upon to protect narcissus against infestation by eelworm. Experiments in chemical sterilisation of the soil with such substances as gas-lime, calcium carbide, naphthaline, carbon-bisulphide, toluol, formaldehyde and ammonia, indicate that this treatment cannot be depended upon to free the soil from eelworm. Finally, experiments were made to determine whether crops liable to attack by this eelworm could be sown with safety on land that had carried diseased bulbs. Rye, winter and spring oats, clover, lucerne, peas, broad beans, rye-grass, onions, wheat, chives, buckwheat and potatoes, were all sown on infested land, *Tylenchus devastatrix* having been recorded on all these food-plants. The plants were examined from the seedling stage onward throughout the growing season, and, except in the case of onions, the various crops were unaffected. These results clearly show that onions should not follow in immediate succession on land that has borne a diseased crop of narcissus. The behaviour of the other crops confirms the theory previously postulated by Ritzema Bos [see this *Review*, Ser. A, v, p. 441], that *T. devastatrix* becomes so adapted to a particular species of food-plant that it will not attack any other species with any severity. Experiments were also conducted in which pots of sterilised soil were sown with the above-mentioned plants, the pots being watered once with water containing eelworms grown in pure culture. In this case, onions were again the only plants affected.

FLETCHER (T. B.). **Agricultural Entomology.**—Reprint from *Ann. Rept. Bd. Scientific Advice for India, 1917–18*; *Calcutta*, 26th April 1919, 15 pp. [Received 23rd June 1919.]

The information contained in this report has been previously noticed [see this *Review*, Ser. A, vii, p. 132].

METCALF (C. L.). *Eumerus strigatus* **again (Dip., Syrphidae).**—*Entom. News, Philadelphia*, xxx, no. 6, June 1919, pp. 170–174.

Previous records of the occurrence of *Eumerus strigatus* are reviewed; the first published report of this fly from America seems to have been in 1910. There are said to be two generations in a year; the food-plants include onion, iris, shallot, narcissus, hyacinth, and *Amaryllis*. It is apparently thoroughly established in widely separated regions of North America, as is another Syrphid, *Merodon equestris* (larger narcissus or daffodil fly). The author considers that it constitutes a real and unappreciated menace, and that the probability is that there will be a sudden and severe outbreak of one or both of these pests when they are more thoroughly acclimatised and experience a period of conditions favourable to their rapid increase. *M. equestris* passes six months in the larval stage, pupating in the soil in February and the adults emerging in late March and ovipositing in May. The food-plants recorded for this species are: *arcissus, Amaryllis, Vallota, Habranthus, Eurycles, Galtonia*, and the wild hyacinth, *Scilla nutans*. Remedial measures suggested are the examination of all bulbs to be planted and the destruction of all infested ones. Bulbs may be partly freed from infestation by submerging them from two to eight days and

then thoroughly drying them. If an attack is noted in the field, the bulbs should be taken up and burnt and the top soil deeply buried in September or early October.

Cockayne (A. H.). **The Wood-borer and its Control.**—*New Zealand Jl. Agric., Wellington,* xviii, no. 4, 21st April 1919, pp. 198–199, 1 fig.

The boring beetle, *Anobium domesticum*, causes great damage in New Zealand. Although a large variety of timber is attacked, a preference is shown for white pine and kauri pine [*Agathis australis*] of which the heart-wood is usually affected. In other timber it is generally the sap-wood that suffers.

The life-history of *A. domesticum* in New Zealand seems to be the same as in Europe and America.

Removal of infested timber should preferably take place in late autumn to early spring, infested material being at once destroyed. Joists, etc., may be sprayed with a solution of lead arsenate at the rate of 1 lb. to 28 gals. of water.

Where possible in houses the affected timber should be removed; if remedial measures have to be resorted to, the affected parts should be sprayed in November, December and January 3 times, with a mixture of 5 parts of benzine to 1 part of creosote or a mixture made by dissolving the equivalent of 2 moth balls of naphthaline to every ½ pint of benzine. In treating furniture it is advisable to inject benzine and creosote into each hole and stop the entrance with a pellet of soap.

Esam (G.). **Insect Pests in Orchard Nursery Stock. Control of Red Mite and Woolly Aphis.**—*New Zealand Jl. Agric., Wellington,* xviii, no. 4, 21st April 1919, pp. 216–217.

Experiments made on two-year-old apple-trees to control red mite [*Tetranychus*] and woolly aphis [*Eriosoma lanigerum*] showed that fumigation and also dipping in lime-sulphur (1 to 6) are of no value, but dipping in oil for 3 minutes at a strength of 1–10 was successful.

Vosler (E. J.). **Some Work of the Insectary Division in Connection with the attempted Introduction of Natural Enemies of the Beet Leafhopper.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* viii, no. 5, May 1919, pp. 231–239, 9 figs.

Since *Eutettix tenella*, Baker (beet leaf-hopper) is known to be the agent transmitting curly-leaf disease to sugar-beet, the author undertook two journeys to Australia with a view to introducing into California the natural enemies found there. A small leaf-hopper was found to be parasitised to the extent of 85 to 90 per cent. by two egg-parasites, *Pterogramma acuminata* and a Mymarid; attention was therefore concentrated upon these two species, and they were transferred to California and reared in sufficient numbers to give them a fair trial. The experiment, however, was a failure, and it must be concluded that *E. tenella* is an unsuitable host.

Some study was made of insects injurious to *Citrus* in Australia, and where they were identical with or closely related to those attacking *Citrus* in California their parasites were investigated with a view to introducing them into California.

Saissetia oleae is largely preyed upon in Australia by the larvae of a Noctuid moth, *Eublemma* (*Thalpochares*) *cocciphaga*, which devours all stages of the scale, but seems to prefer the eggs. The larva makes a case of the remains of its host, under which it moves along the twigs in search of further prey. A new generation of this moth has been successfully reared in California, and it is hoped shortly to be able to introduce it into the citrus groves. It is the most promising of the material brought from Australia.

From various Australian species of *Pseudococcus* (mealy-bug) two primary parasites, *Leptomastix* sp. and *Anagrus* sp., were transported to California and liberated on *Pseudococcus citri* (citrus mealy-bug), *P. gahani* (citrophilus mealy-bug) and *P. maritimus*. Although *Leptomastix* sp. oviposited in both *P. citri* and *P. gahani*, no parasites were reared from the material. *Pachyneuron* sp., a small Encyrtid, and *Tetracnemus* sp., all internal parasites of *Pseudococcus aurilanatus* (golden mealy-bug), were introduced from Australia and released upon *P. aurilanatus*; it is too early to know whether this is a successful importation. *Pachyneuron* sp. was also released upon *Pseudococcus maritimus* and oviposited readily on that species, but did not develop. A small Coccinellid, *Midas pygmaeus*, was also collected on mealy-bugs in Australia and brought in a living condition to California. It preys readily on *Pseudococcus citri* and seems a promising addition to the imported enemies of mealy-bugs.

De Ong (E. R.). **What hinders Dried Fruit Sales.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 5, May 1919, pp. 240–243, 4 figs.

The manner of infestation of dried fruits by such insects as *Plodia interpunctella* and *Silvanus surinamensis* is described. The best preventives of insect infestation are keeping the packing-house free from all insect-breeding waste, thorough drying of all new stocks, clearing out all stocks by the end of winter or early spring, or fumigation or sterilisation with heat in early spring of any stocks it is desired to keep through part of the summer. Emphasis is laid on the necessity for care in sterilising, fumigating or protective operations to secure the maximum benefit, and in preventing the access of all insects to fruit after it has been treated, either while drying, being packed or after it is in the shipping case.

Cockerell (T. D. A.). **The Girasole or Jerusalem Artichoke.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 5, May 1919, pp. 243–250, 7 figs.

Helianthus tuberosus (Jerusalem artichoke) in California suffers from no serious pests, though a species of cutworm, probably *Euxoa agrestis*, destroys a number of the seedlings. In Iowa, however, the plant is largely damaged by a root Aphid, while a mealy-bug, *Pseudococcus trifolii*, also infests the tubers.

MACKIE (D. B.). **The Status of the Codling Moth in its Relation to the Walnut Industry.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* viii, no. 5, May 1919, pp. 250–256, 3 figs.

Infestation of walnuts by *Cydia* (*Laspeyresia*) *pomonella* (codling moth) has so much increased recently that it appears probable that a strain of this species has been developed which can complete its life-cycle on walnut and finds that food-plant congenial. The damage to this important crop in 1918 shows that the moth has potentialities for developing into the most serious of walnut pests. It has, however, been proved that it can be controlled both in the field and through the channels of the trade, and that it is only necessary that concerted action be taken by growers and dealers to prevent losses to future crops. Development on walnuts is not yet fully understood, but the methods of handling the crop in order to eliminate infestation are fully dealt with. These include treatment of the sacks with live steam, hot water, hot air and an electric mangle. [See also this *Review*, Ser. A, vii, p. 317.]

ARMITAGE (H. M.). **Controlling Mealybugs by the Use of their Natural Enemies.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* viii, no. 5, May 1919, pp. 257–260.

The species of citrus-feeding mealy-bugs that occur in Southern California are *Pseudococcus citri*, Risso (citrus mealy-bug), *P. gahani*, Green (citrophilus mealy-bug) and *P. maritimus*, Ehrh.; to these has been added during the last season *P. kraunhiae*, Kuw. (Japanese mealy-bug), which as yet occurs only in one locality, where an attempt is being made to eradicate it. There are many natural enemies of these Coccids in California, but they have not all proved suitable for rearing and distribution on a large scale. *Sympherobius barberi* and *S. californicus* (brown lace-wings) are both excellent winter and spring predators, but are themselves highly parasitised, as is also *Chrysopa* sp. (green lace-wing). The Coccinellid, *Hyperaspis lateralis*, another native predator, is an effective check on *P. citri*, but does not readily adapt itself to *P. gahani*. An Agromyzid fly, *Leucopis bella*, devours many egg-masses, but the most promising enemy is apparently the Coccinellid, *Cryptolaemus montrouzieri*, originally introduced from Australia. The manner of rearing and distributing it is described. Under natural conditions it is able rapidly to clear an infestation of mealy-bugs from citrus orchards, but appears too late to protect the tree. By having *C. montrouzieri* available for liberation in the spring and distributing it in quantities that will give it an equal start with the mealy-bug, the latter may increase for a short time but will not become sufficiently numerous to injure the tree or crop. During the past season 54,330 adults of *C. montrouzieri* were liberated on 95 properties infested with mealy-bugs, about 60 per cent. of these being collected in the field and the rest in the insectary. In the present season the equipment has been doubled and it is hoped that the figures will be increased greatly during the coming year, with corresponding success.

Some attempt has also been made to rear *Paraleptomastix abnormis*, Gir., a small Hymenopterous parasite of *Pseudococcus citri*, which was introduced from Sicily about 4 years ago. It is hoped to liberate

this parasite, which readily establishes itself under Californian conditions, in large colonies wherever its host occurs. [See also this *Review*, Ser. A, v, p. 266.]

Arens (P.). De Bestrijding van de Witte Luis met Petroleum-Zeep-Emulsie. [Combating the White Scale with Petroleum-Soap Emulsion.]—*Meded. Proefstation Malang, Soerabaya*, no. 7, 1915, pp. 20–24. [Received 23rd June 1919.]

A species of *Pseudococcus*, probably *P.* (*Dactylopius*) *adonidum*, L., was one of the insects that became more numerous as a result of the prolonged dry weather in 1913 and 1914. Another factor favourable to the increase of this scale is the substitution of lamtoro (*Leucaena glauca*) for dadap [*Erythrina*] as a shade-tree, the former being a favoured food-plant. The chief injury to coffee is that done to the young berry-clusters; the new tips of the twigs and the roots also suffer. It has been found that a carefully applied contact-spray containing 4 per cent. of petroleum is efficient against this scale.

LEGISLATION.

Plant Legislation in Montserrat.—*Rept. Agric. Dept. Montserrat 1917–18*; *Barbados, 1919*, pp. 39–40. [Received 25th June 1919.]

During 1917–18 a proclamation, dated 24th October 1917, was issued to prevent the introduction of *Pectinophora gossypiella* (pink bollworm) into the Island. The principal provision is as follows: The importation into the Presidency of seed-cotton or cotton-seed from all countries outside the colony of the Leeward Islands is prohibited, save and except from some other Presidency of the Colony, or from the Colony of Trinidad and Tobago and its Dependencies, or from the Colonies of Grenada, St. Vincent, and St. Lucia, provided that small quantities of cotton-seed for experimental purposes may be imported into the Presidency on the written permission of the Curator of the Botanic Station, on such terms and conditions as he may prescribe.

The Pest Act.—*Planters' Chronicle, Coimbatore*, xiv, no. 21, 24th May 1919, pp. 303–307.

The text is given of the Madras Act, No. iii of 1919, passed 12th April 1919, for the prevention of the spread of insect pests, plant diseases and noxious weeds.

Pratt (A. O.). The Pink Bollworm, the Boll Weevil and Lower California Cotton.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 5, May 1919, pp. 266–267.

The Northern District of Lower California, which is politically a part of Mexico, but economically a dependency of the United States, is as yet free from cotton pests, although cotton constitutes the principal source of the wealth of the district. In order to maintain this immunity a Quarantine Order has been issued prohibiting the importation into the district of cotton seed except through the ports of Mexicali and Los Algodones. The text of the decree is given. Slight modifications through governmental orders make this decree include cotton as well as cotton seed.

MASKEW (F.). **Report for the Months of February and March 1919.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 5, May 1919, pp. 271–274.

Insect pests intercepted during February and March 1919 included: From Central America: *Aspidiotus cyanophylli, Pseudococcus* spp., *Chrysomphalus scutiformis, Ceramidia scintillocollaris*, and unidentified Lepidoptera on bananas; *Chrysomphalus aurantii* on oranges. From China: *Cylas formicarius* in sweet potatoes; *Aspidiotus simillimus translucens* and *Parlatoria pergandei* on oranges; *Aphis* spp. on plum trees; borers in dry bark and unidentified Lepidopterous larvae in orange peel. From Florida: *Phomopsis citri* and *Lepidosaphes beckii* on grape-fruit. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Chionaspis inday, Hemichionaspis minor* and *Chrysomphalus aonidum* on coconuts; *Pseudococcus citri* on pumpkins; and *Coccus longulus* on betel leaves. From Mexico: *Lepidosaphes gloveri, Chrysomphalus scutiformis* and *Parlatoria cinerea* on limes; *Lepidosaphes beckii* on lemons, limes and oranges; *Chrysomphalus aurantii* and *C. aurantii citrinus* on lemons; *Heliothis* (*Chloridea*) *obsoleta* on tomatoes; *Chrysomphalus aonidum* on pot plants; and Coleopterous larvae in sweet potatoes. From Australia: *Calandra granaria* in wheat. From Cuba: *Pseudococcus* spp. on pineapples. From Japan: *Pseudococcus* sp., *P. comstocki*, and Cicada eggs on persimmon; *Lecanium kunoensis*(?) on plums; *Pseudaonidia duplex* on plums, azaleas and camellias; *Hemichionaspis aspidistrae* on *Aspidistra lurida* and oranges; *H. minor* on tangerines and oranges; *Lepidosaphes beckii* on oranges; *Leucaspis japonica* on persimmon; *Agromyza schineri* and *Pseudococcus* sp. on *Wistaria*; *Parlatoria* sp. on camellias; *Thyridopteryx ephemeraeformis* on *Daphne*; and Lepidopterous larvae in dry wood. From Holland: *Lepidosaphes ulmi* and *Saissetia hemisphaerica* on boxwood. From Oregon: *Cydia pomonella* on apples. From Pennyslvania: *Tetranychus mytilaspidis* on rose plants; *Diaspis boisduvali* on variegated pineapple; *Cerataphis lataniae* and *Pseudococcus nipae* on *Cocos weddelliana*. From New York: Green aphis on *Hibiscus*; *Pseudococcus* sp. on Cape jasmine. From North Carolina: *Aleurodes citri, Pseudococcus* sp. and *Tetranychus mytilaspidis* on Cape jasmine. From Nevada: *Heterodera radicicola* in potatoes. From Connecticut: *Pseudococcus* sp. on *Gardenia*. From Texas: Mantid eggs and unidentified Lepidopterous larvae on persimmon trees; *Parlatoria pergandei* on grape-fruit. From Utah: *Aegeria* (*Sanninoidea*) spp. in peach tree. From Kansas: Nematodes on apple and pear seedlings. From Louisiana: *Aleurodes* sp. on jasmine. From Washington: *Cydia pomonella* and *Eriosoma lanigerum* on apple. From Wisconsin: *Pseudococcus citri* and *Chrysomphalus aonidum* on lemon. From France: *Diaspis carueli* and *Coccus hesperidum* on *Thuya*. From Argentina: Lepidoptera in potatoes.

GAHAN (A. B.). **Notes on some Genera and Species of Chalcid Flies belonging to the Aphelininae with Description of a New Species.**—*Proc. U.S. National Museum, Washington, D.C.*, lv, 1919, pp. 403-407, 5 figs.

Since the description of the genus *Centrodora* in 1878 with *C. amoena*, Först., as the type, both genus and species have remained unrecognised.

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Paraphelinus speciosissimus, Girault, belongs to this genus, and is probably the same species. *Agonioneurus locustarum*, Girand, is a synonym of *C. amoena*. *Paraphelinus*, Perkins, thus becomes a synonym of *Centrodora*, Förster. *C. speciosissimus* has been found parasitic in the puparia of *Mayetiola destructor*, Say, and in the eggs of *Xiphidium* sp.

Tumidiscapus orthopterae, sp. n., which is here described, has been reared from eggs of an Orthopteron, deposited in the stems of a grass, *Andropogon glomeratus*.

GOSSARD (H. A.). **Preparing for Apple Aphid Outbreak.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, iv, no. 3, March 1919, pp. 89-91, 1 fig. [Received 24th June, 1919.]

Owing to the increased numbers of Aphid eggs, chiefly of *Siphonaphis padi* (*Aphis avenae*) (European grain aphis) noticed in orchards, timely spraying is suggested. For this purpose various sprays have been tried. Lime-sulphur solution (33° Bé.), diluted 1 to 8 or 1 to 9, killed from 85 to 100 per cent. of the living eggs; lime-sulphur, 1 to 8, plus Blackleaf 40, 1–500, killed 97 per cent. Blackleaf 40 diluted with water, 1–500, plus laundry soap 2 lb. to 50 U.S. gals., killed 45 per cent.; when Fels Naptha was substituted for laundry soap only 5 to 33 per cent. were killed. Scalecide diluted with 15 parts of water killed 25–65 per cent. Crude carbolic acid, 2 per cent. solution, plus 2 lb. of soap to 50 U.S. gals. of water, killed from 93 to 100 per cent. without injuring the trees. Sodium hydroxide 2 pints in 98 c.c. of water [*sic*] killed 85 to 95 per cent. The effect on young Aphids is the same as on the eggs. The best time for spraying is when the buds begin to swell and the first young Aphids are seen. Should the presence of Aphids coincide with that of codling moth larvae [*Cydia pomonella*] the trees may be sprayed as soon as the petals fall with 1 U.S. gal. lime-sulphur solution to 40 U.S. gals. water and 2½ lb. of arsenate of lead paste or 1¼ lb. of powder plus ½ pint of nicotine sulphate solution (40 per cent.). The spraying should be repeated in 8–10 days.

ABBOTT (W. S.). **A Study of the Effect of Storage, Heat, and Moisture on Pyrethrum.**—*U.S. Dept. Agric. Washington, D.C.*, Bull. no. 771, 21st February 1919, 6 pp. [Received 24th June 1919.]

Various experiments made with whole and ground flower-heads of pyrethrum to test its efficacy as an insecticide after exposure to moisture, heat and weather are described. Two methods of testing were used. For the dusting method, small potted nasturtium plants infested with *Aphis rumicis*, L., were thoroughly dusted by means of a hand dust-gun. For the dipping tests large specimens of the cockroach, *Phyllodromia* (*Blattella*) *germanica*, L., were dropped into a vessel, containing the powder, and well shaken. They were then placed in bottles for observation.

Exposure to the weather for 12 weeks does not noticeably reduce the potency of the ground or whole flower-heads, but after 21 weeks only 60–70 per cent. of the cockroaches were killed in 120 hours. Whole flower-heads may be kept in tightly closed glass containers for 5½ years without losing their efficiency, whereas ground flower-heads, become useless after that lapse of time, but are practically unaffected

after 150 weeks of similar treatment. After 34 weeks of exposure in a room the ground flower-heads were not injured, after 136 weeks their value was greatly reduced and they were worthless after 150 weeks. The whole flower-heads were unaffected after the same exposure. Ground flower-heads may be safely heated for 18 hours to a temperature of 120° C., but 130°–140° C. will completely destroy their effectiveness. Soaking in hot water for 24 hours reduces the potency of ground flower-heads to a greater extent than the same time in cold water.

GIROLA (C. D.). **Mejores Sistemas para combatir las siguientes Plagas : *Diaspis pentagona, Aspidiotus,* Pulgones, Taladrillos, Bicho de Cesto, etc. Conveniencia de combatir las Plagas de las Plantas por Medio de los Enemigos naturales (entomófagos).** [The best Methods of combating *Aulacaspis pentagona, Aspidiotus,* Aphids, Borers, Bagworms, etc. The Advantage of controlling Plant Pests by Means of Natural Enemies.]—*Anales Soc. Rural Argentina, Buenos Aires,* liii, no. 4, 1919, 149–151. [Received 19th June 1919.]

The method of introduction of *Prospaltella berlesei,* How., for the control of *Aulacaspis* (*Diaspis*) *pentagona,* Targ., is described, and it is stated that 3,000,000 twigs bearing this parasite were distributed during 1914–1916 among the plantations infested with *A. pentagona,* this method having given better results than any previously tried. Mention is made of similar introductions of other enemies, such as *Novius cardinalis* for the control of the scale, *Icerya purchasi,* and the Hymenopterous parasites, *Eurytoma caridei,* Brèt., *Perissocentrus argentinae* var. *caridei,* Brèt., *Lindesonius caridei,* Brèt., and *Parexorista caridei,* Brèt., to destroy *Oeceticus platensis,* Berg (Argentine bagworm).

SENSTIUS (M. W.). **Over eene recente Insectenplaag op Koffiezaadbedden.** [An Insect Pest of recent Occurrence in Coffee Seed-beds.]—*Meded. Proefstation Malang, Soerabaya,* no. 7, 1915, pp. 5–19, 3 plates. [Received 23rd June 1919.]

Intensive injury to seed-beds of various varieties of coffee in Java was found to be due to insect larvae. About 206,000 of these were collected in 5 days from an area of about 7,500 square feet, *i.e.,* about 28 per square foot. Wireworms, probably the Tenebrionid, *Opatrum depressum,* were the most abundant; they attack the roots of young coffee plants. Though the adult beetle has been recorded in Java as injuring tobacco above ground, no injury of this type was noticed in the present case. Tipulid larvae, which were next in order of abundance, feed on the inner bark of the coffee plants just above the root-collar. Small numbers of *Agrotis* sp., May-beetle larvae and Elaterids were also found. The wireworms and Tipulids appear to be widely distributed, though little noticed, in Java. The adults of *O. depressum* may be captured by spreading on the seed-beds some light-coloured material under which the beetles will shelter. When this is watered some days later they immediately emerge and being clearly visible against the light background their capture is easy. The Tipulids may be combated by covering the beds with alang-alang

grass which must be removed, burnt and replaced at regular intervals during the flight period, thus destroying the eggs. Collection of the larvae is also necessary. A measure recommended against the larvae of both pests is watering the beds, 3–4 months before the seed is planted, with a weak solution of carbolineum, 1 part to 250 of water. If this insecticide is used when the beds have already been sown, a solution of 1 in 500 must be used at the rate of 3½–7 oz. per 11 square feet.

WIERENGA (O. M.). **Waarschuwing tegen de Anggrang (Roode Mier).** [A Warning against the Red Ant, *Oecophylla smaragdina*.]—*Meded. Proefstation Malang, Soerabaya*, no. 13 [1916], pp. 15–16. [Received 23rd June 1919.]

As it is very difficult to work in plantations that are severely infested by *Oecophylla smaragdina*, the eradication of this ant is very necessary. Of all the methods tried the only one of real value is the destruction of the nests, which must be collected, and the ants and their eggs thrown into hot water. As attempts will be made to form new nests these must be looked for and burnt out by means of a gasolene torch, which should be fastened to a 6-foot stick in order to prevent the operator from being bitten. For some time after the nests have been dealt with the ground will swarm with ants and the only means of protecting the workers consists in rubbing the legs with rice powder. As the powder is applied wet the surface becomes so smooth that the ants are unable to climb up it.

SCHENK (P. J.). **In en op den Bodem levende Plantenvijanden. II.** [Plant Enemies living in or on the Ground.]—*Tijdschr. Plantenziekten, Wageningen*, xxv, no. 3, May 1919, pp. 101–125, 8 figs.

The first portion of this paper on plant pests in Holland has already been noticed [see this *Review*, Ser. A, vi, p. 498]. Some species of Elaterid beetles, including *Lacon murinus* and *Agriotes lineatus*, are injurious to vegetables and fruits; bait-traps or poison-baits are advocated against them. Tipulid larvae caused extremely severe and wide-spread damage to vegetable and fruit crops planted on grassland during the War. In one instance 300 strawberry plants only remained out of 25,000. Against *Euxoa (Agrotis) segetum* and other cutworms, benzine is recommended in preference to carbon bisulphide. Small holes are made in the ground and a thimbleful of benzine is poured into each. The holes must be immediately closed. The adults may be captured in light-traps. In Holland *Gryllotalpa gryllotalpa* occurs chiefly in peat soil, but this mole-cricket may be found in sandy and clay soils provided their character is not too pronounced. Trap-trenches are used against this pest, the life-history of which is still obscure on many points. About 300–400 individuals were securely confined together and the number gradually decreased until the sole survivor was ultimately found dead of starvation. This proves *G. gryllotalpa* to be cannibalistic when other food is not available. *Blaniulus guttulatus* appears to be the most harmful millipede. Bait-traps are recommended against it.

MAARSCHALK (H.). **Bestrijding van de Bessenbastaardrups.** [Measures against the Larvae of *Pteronus ribesii*.]—*Tijdschr. Plantenziekten, Wageningen*, xxv, no. 3, May 1919, Bijblad pp. 13–16.

Experiments with barium chloride have shown that a solution with a strength of 1½ per cent. destroys the larvae of the currant sawfly, *Pteronus ribesii*, Scop., while doing no injury to the bushes. It is however dearer than Paris green, easily washed off by rain, and colourless, so that it is not possible to see where the spray has been applied. This last disadvantage can be obviated by adding about ½ part of lime to 100 parts by weight of water to the spray applied when the bushes are in blossom. Against the second generation of larvae the solution should be used without lime, as the fruit is then on the bushes; this application should be made at least one week before gathering the fruit. The danger of poisoning is very remote, barium chloride being far less toxic than arsenicals.

ROLET (A.). **Traitement simultané de la Cochenille, de la Fumagine et du *Cycloconium* des Oliviers.**—*Jl. d'Agric. Pratique, Paris*, xxxii, no. 20, 19th June 1919, pp. 413–415.

The various sulphur sprays for simultaneous treatment of the insects producing honey-dew, such as *Saissetia* (*Lecanium*) *oleae*, etc., and of the fungus diseases encouraged by its presence, as well as *Dacus oleae* which is attracted by it, are reviewed. The formulae preferred in various countries are discussed and the recommendations for the use of polysulphides by del Guercio [see this *Review*, Ser. A, iii, p. 430] and by Savastano [*loc. cit.*, ii, p. 412] are given.

Reports on the State of the Crops in each Province of Spain on the 20th May 1919.—*Bol. Agric. Técnica y Económica, Madrid*, xi, no. 125, May 1919, pp. 426–442.

Aphids have done much damage to vegetable crops, particularly in bean-fields in Castellón, and also to almonds in certain localities; for the latter a spray is recommended of 1½ per cent. each of soft soap and petroleum in water. The caterpillars of *Tortrix viridana* have attacked oaks in Córdoba, but the damage is decreasing and it is hoped that the acorn crop will be normal; in Huelva, however, oak pests have been more severe and it is feared that the acorn-crop, which is locally valuable for feeding pigs, will be worthless. Barley and wheat in Córdoba have suffered from the attacks of a bug, *Aelia rostrata*. Locusts have also appeared in some localities of this Province, and in Huelva, where materials for remedial measures are lacking. In the Province of Madrid locusts have invaded certain districts in large numbers and a campaign has been undertaken by the military authorities under the direction of the Board of Agriculture, with the small allowance of materials available. In Lérida Aphids have been extraordinarily abundant in bean-fields and orchards, probably owing to the unusually mild winter.

SIEGLER (E. H.). **A Brief Analysis of the Dusting Method.**—*Rept. Maryland Agric. Soc., College Park, Md.*, ii (1917), 1st March 1918, pp. 86–98. [Received 25th June 1919.]

Experiments made in the United States to control pests of apples and peaches by means of the dusting method are still being continued.

So far the results obtained show that the codling moth [*Cydia pomonella*] and curculio [*Conotrachelus nenuphar*] can only be controlled by this method when the infestation is very slight. Several formulae that have been tested are given and the mode of application described.

BRYAN (C. E.). **How many Applications of Spray Material can be applied profitably in developing a Peach Crop.**—*Rept. Maryland Agric. Soc., College Park, Md.*, ii (1917), 1st March 1918, pp. 98–102. [Received 25th June 1919.]

The following method has proved successful in the author's personal experience. A dormant spray of 10 per cent. lime-sulphur is applied 3 to 4 weeks before the blossoms open. As soon as the fruit is set a spray of 20 lb. of atomic sulphur, 20 lb. of hydrated lime made into milk, and 5 lb. of dry arsenate of lead to 200 U.S. gals. of water should be applied and repeated in about 3 to 4 weeks time. The fourth and subsequent sprays should be of atomic sulphur only and applied every 3 to 4 weeks until within 4 weeks of harvest. During rainy weather the spraying should be repeated every 3 weeks.

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. Montserrat 1917–18*; *Barbados*, 1919, pp. 29–30. [Received 25th June 1919.]

The extent of attacks of cotton-stainers [*Dysdercus*] in 1917 was similar to that in previous years. Owing to the results obtained in St. Vincent from the destruction of the silk-cotton and mahoe trees, the community have expressed the desire that a similar ordinance be put into force in Montserrat.

It is expected that this pest will be still more prevalent in 1918 owing to the increased proportion of silk-cotton trees bearing fruit during the year. A small Malvaceous plant (*Sida acuminata*) has also been definitely connected with supporting the existence of cotton-stainers from one season to another.

RUNNER (G. A.). **The Tobacco Beetle: An Important Pest in Tobacco Products.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 737, 17th March 1919, 77 pp., 4 plates, 16 figs. [Received 24th June 1919.]

This bulletin describes the character and extent of damage done by *Lasioderma serricorne*, F., chiefly to stored tobacco. All stages of the beetle are described. There are usually 3 generations in the year, but under warm conditions there may be as many as 5 or 6. The complete life-cycle varies from 45 to 70 days according to the temperature. Eggs are deposited in the food substance. The larvae appear in 6 to 10 days and pupate after 30 to 50 days. The pupal stage lasts 5 to 10 days and the adults live 3 to 6 weeks. Hibernation usually occurs in the larval stage.

The erroneous belief that *L. serricorne* attacks growing tobacco is probably due to confusion with other tobacco pests, such as *Epitrix parvula*, F. (tobacco flea-beetle); *Catorama tabaci*, Guér. (larger tobacco beetle); *Silvanus surinamensis*, L.; and *Cathartus advena*, Walt.

Other stored tobacco pests that have been recorded are: *Sitodrepa panicea*, L., *Calandra oryzae*, L., *Dermestes vulpinus*, F., *Trogoderma tarsale*, Melsh., *Tenebroides mauritanicus*, L., *Mezium americanum*, Lap., *Attagenus piceus*, Oliv., and *Catorama impressifrons*, Fall, the last two as infesting the seed.

Frost exercises a great check on *L. serricorne*, the rapid increase of which is also prevented where the tobacco is allowed to become dry. Its most important predatory enemy is a Clerid beetle, *Thaneroclerus girodi*, Chevr., which is described in detail. The eggs are usually laid in groups of 2 or 3 in the burrows of the tobacco beetle, the incubation period generally lasting about 9 days. Each female lays about 18 eggs. The larval period corresponds closely to that of its host, lasting 42 to 62 days according to temperature and abundance of food. The pupal stage occupies about 7 days. The larvae feed on the eggs, larvae and pupae of *L. serricorne*, the adults on the larvae, pupae and adults, but both larvae and adults become cannibals when deprived of other food.

Hymenopterous parasites of *L. serricorne* include *Aplestomorpha pratti*, Crawf., *A. vandinei*, Tucker, the larva of which feeds externally on the larva and pupa of the tobacco beetle, and a species of *Norbanus*. A Solpugid spider does considerable damage to cigars in its attempt to reach the eggs and larvae of the tobacco beetle. Mites known to attack the eggs include species of *Cheyletus*, *Tyroglyphus* and *Rhagidia*, the latter having been recorded from the Philippines.

The usual remedial measures are described and include freezing, sterilisation by dry heat or steam, trapping by mechanical means, fumigation with carbon bisulphide, hydrocyanic-acid or other gasses and exposure to X-rays.

Severin (H. C.). **Injurious Corn Insects.**—*South Dakota Agric. Expt. Sta., Brookings*, Bull. no. 178, March 1918, pp. 780–813, 16 figs. [Received 23rd June 1919.]

The life-cycle and remedial measures for the most important maize pests in Dakota are described, including: *Cirphis unipuncta*, Haw. (army-worm); the grasshopper, *Melanoplus differentialis*; *Aphis maidiradicis*, Forbes (corn-root aphis); white grubs [*Lachnosterna*] and wireworms.

Beeson (C. F. C.). **Forest Entomology.**—Reprint from *Ann. Rept. Bd. Scientific Advice for India, 1917–18*; *Calcutta*, 26th April 1919, 4 pp. [Received 30th June 1919.]

A continuation of the previous year's work is described [see this *Review*, Ser. A, vi, pp. 519, 521]. An additional ten thousand sal trees [*Shorea robusta*] were attacked by the Longicorn beetle, *Hoplocerambyx spinicornis*. With regard to the Cossid moth, *Duomitus ceramicus*, observations show that this beehole borer appears at an earlier stage and its incidence rises more rapidly in plantations made since 1900 than in older ones. A method was devised for determining the age of beeholes, and it is estimated that each tree in the final crop of an average teak plantation will contain a sufficient number of

beeholes to render it useless for timber. The effect of a dense undergrowth apparently delays the appearance of the borer and reduces the incidence, but not to a very great extent [see this *Review*, Ser. A, vii, p. 135].

The moths, *Hyblaea puera* and *Pyrausta machaeralis*, have been less numerous, and have been replaced by Noctuid pests to some extent.

BÉGUET (M.). **Tableau synoptique de Détermination des Stades évolutifs de la** *Schistocerca peregrina*, **Ol.**—*Bull. Soc. Hist. Nat. Afr. Nord, Algiers*, **x**, no. 6, 15th June 1919, p. 129, 4 figs.

This chart shows the various stages of development of the locust, *Schistocerca peregrina*, Ol., with sufficient description to serve for the recognition of each, and gives some indication of the amount of damage to be expected from each stage.

NEAVE (S. A.). **The Use of Scientific and Popular Names in Economic Biology.**—*Ann. Applied Biol., Cambridge*, **v**, nos. 3–4, April 1919, pp. 274–275.

Lack of uniformity in nomenclature with regard to both popular and scientific names is the frequent cause of one or the other being omitted in works on economic biology. To alleviate this difficulty it is suggested that a central body be formed, the duty of which would be to collect data as to all recognised popular names throughout the English-speaking world. A list, reducing these names to a minimum, should be compiled, to which as far as possible all authors should agree to adhere.

To make comparisons of results possible between those who speak different languages the use of scientific names as well as popular ones is essential. If objected to in the text they may be given as a footnote, as is done in some of the publications of the United States Department of Agriculture.

An appeal is made for final decision as to the accepted scientific names of the principal animals and plants of economic value, and this would remove one of the chief objections to their use. Care should also be taken in the selection of popular names, and these should be as informative as possible.

OKAMOTO (H.). **Honpo-San Kusa-Kagero-Kwa ni Kwansuru Kenkyu.** [Studies on the CHRYSOPIDAE of Japan.]—*Hokkaido-Noji-Shikenjo Hokoku [Report of the Hokkaido Agricultural Experiment Station], Sapporo*, no. 9, 30th March 1919, 76 pp., 7 plates.

The morphology, habits and life-history, together with the characters of all the genera and species of Chrysopids that are known to occur in Japan, are described. Records of distribution and importance from the agricultural point of view are added. As regards life-histories, *Chrysopa japana*, sp. n., has two generations a year, the adults appearing in June and August; hibernation occurs in the larval state within a cocoon. *Chrysopa nipponensis*, Okam., passes the winter in the adult stage. This species devours on an average about 100 Aphids a day, and a single female lays as many as 580 eggs.

Descriptions are given of 35 species, including four new ones viz.:—*Chrysopa japana*, *C. parabola*, *C. suzukii* and *C. kintoki*.

As regards those of economic value, *Chrysotropia japonica* and *Chrysopa sachalinensis* prey on *Phorodon humuli*; *C. japana* and *C. sapporensis* on *Brevicoryne* (*Aphis*) *brassicae*; *C. matsumurae* and *C. boninensis* on *Pseudococcus* (*Dactylopius*) *citri*, *Icerya seychellarum* and *I. purchasi*; *C. cognata* on *Hyalopterus arundinis* (*pruni*) and *Prociphilus bumeliae*. It was found experimentally that a larva of *Chrysopa japana* ate on an average over 2,000 individuals of *Brevicoryne brassicae* during that stage and an adult over 4,000 individuals, and this is therefore a highly beneficial species.

OJIMA (G.). **Ichijiku Mimumushi** [Fig-boring insect].—*Byochugai Zasshi* [*Journal of Plant Protection*], *Tokyo*, vi, no. 6, 5th June 1919, pp. 427–430.

The larva of a fig-infesting moth, *Cirrhochrista brizoalis*, Moore, appears in May and June, and bores the stalk of the fig, whence it penetrates into the fruit, which consequently becomes deformed and ultimately falls. This attack by the larva is repeated in other sound fruit at intervals of about five days. About the middle or end of July, it becomes full-grown and leaves the fruit, pupating within a silken cocoon in crevices of the bark. At the end of August or in September the adult emerges and lays eggs that soon hatch. The young larvae pass the winter in a silken web. Such larvae pupate at the end of April and give rise to another generation of adults in May and June.

This moth also attacks the fruit of *Ficus retusa*. The best remedial measure is the removal of early infested fruits, which are characterised by the presence of brownish spots on the skin.

TAKENOUCHI (K.). **Honposan Kichi Habachi-kwa Mokuroku.** [List of the known TENTHREDINIDAE of Japan.]—*Konchusekai* [*Insect World*], *Gifu*, xxiii, no. 61, 15th May 1919, pp. 182–188.

In this list 142 species of TENTHREDINIDAE hitherto described from Japan are recorded.

KITAJIMA (Y.). **Futatsunoshinkui** *Sinoxylon japonicum*, **Lesne.** [The Two-horned Borer, *Sinoxylon japonicum*, Lesne.]—*Sangyo Shimpon* [*Journal of the Silk Industry*], *Tokyo*, no. 316, 1st July 1919, pp. 631–633, 7 figs.

The Bostrychid beetle, *Sinoxylon japonicum*, Lesne, has not hitherto been recorded as injurious to the mulberry tree. In 1919, however, it has done no small damage to mulberry plantations in Nagano. The adult bores just beneath the bud in late spring and burrows into the stem, usually making a tunnel about one inch in length. This seems to be repeated several times by the same individual; the affected buds fall and die and often the stem itself tends to break. The author was unable to ascertain where the early stages had been passed, but this beetle is known to infest both persimmon (*Diospyros*) and *Quercus*, and both of these trees occur in the same plantations.

YANO (M.). **Jurai Honpo ni oite Daihassei o naseru Shinrin-Gaichu n. tsuite.** [Injurious Forest Insects that have hitherto occurred in great abundance in Japan.]—*Sanrin-Koho* [*Public Forestry Report*], *Imperial Forestry Bureau, Tokyo*, no. 6, 15th June 1919, pp. 453–470.

Neither of the two books dealing with insects in Japanese forests, one by Professor Sasaki recording about 160 species and the other by Professor Niishima dealing with nearly 280, records more than half of the injurious species that occur in large numbers in Japanese forests.

These include:—Hymenoptera. TENTHREDINIDAE: *Nesodiprion basalis*, the larvae of which appear in April and August and attack the leaves of *Pinus densiflora*; *Diprion nipponica*, the larvae of which occur from August to November and attack *Pinus densiflora* and *Larix leptolepis*; *Monoctenus cryptomeriae*, the larvae of which attack *Cryptomeria japonica* in June and July; and *Cephaleia koebelei*, the larvae of which appear in July and attack *Larix leptolepis*.

Coleoptera. SCOLYTIDAE: *Myelophilus minor*, the adults of which appear in May and infest the bark of *Pinus thunbergii*, quickly causing the death of these trees; *Crossotarsus* sp. damaging *Quercus crispula*. CURCULIONIDAE: *Hylobius macilentus*, the adults of which oviposit on the roots of the camphor tree, which is killed by the larvae eating the inner layer of the bark; *Rhynchaenus* (*Orchestes*) *excellens* attacking the leaves of *Quercus glandulifera* and other trees; *Phyllobius japonicus*, the adults of which attack the buds of *Cryptomeria* in April. SCARABAEIDAE: *Anomala costata*, the adult of which appears in July and attacks *Cryptomeria japonica*, *Chamaecyparis obtusa*, *Pinus densiflora*, *Larix leptolepis*, *Abies firma*, etc.; about ten species of root-infesting grubs, mostly those of *Melolontha japonica* and *Heptophylla picea*, attack seed-beds. CHRYSOMELIDAE: *Nodostoma* sp. attacking leaves of *Cryptomeria japonica*, *Pinus* spp., *Chamaecyparis obtusa*, *Larix leptolepis*, etc.

Lepidoptera. LASIOCAMPIDAE: *Dendrolimus remota*, the caterpillars of which appear in August and feed until October, hibernating in this stage; *Kunugia yamadai*, Nagano, the caterpillars of which occur in April and attack *Quercus serrata*, *Q. glandulifera*, etc., this species occasionally appearing in immense numbers in Central Japan. LYMANTRIIDAE: *Porthetria* (*Lymantria*) *fumida*, the larvae of which appear in May and June and attack *Tsuga sieboldi* and *Abies firma*; *P.* (*Lymantria*) *dispar*, the caterpillars appearing in April, May and June and attacking many trees, including *Pinus densiflora* and *P. thunbergii*; *Euproctis flava*, the caterpillars of which appear in September on many trees; *Dasychira abietis*, the caterpillars of which attack *Cryptomeria* in August. NOTODONTIDAE: *Egonokia derdix*, attacking beeches in July and August and the cause of severe injury to forests in 1917. SATURNIIDAE: *Caligula japonica*, the caterpillars occurring from April to June and attacking chestnut, camphor and many other trees. GEOMETRIDAE: *Zethenia rufescentaria*, of which there are one or two generations in spring and summer, sometimes seriously damaging *Cryptomeria* forests. PSYCHIDAE: *Clania minuscula*, the larvae of which attack the foliage of many trees from August till October. ELACHISTIDAE: *Coleophora laricella*, the larvae attacking the foliage of *Larix leptolepis* in July and the buds in the following spring.

The fluctuating occurrence of these injurious insects, due to the quantity and quality of food present, meteorological conditions and the presence of natural enemies, is discussed, many examples being quoted. In forests composed of a single species of tree, the parasites of injurious insects may continue to increase while the host remains numerous, but decrease to such an extent when there is a reduction in number of the host that they are often incapable of effecting anything against the next generation; in a mixed forest on the other hand some parasites may find another host that is infesting another species of tree. For example, in 1917 the author observed that in a pure pine-forest there were only 10 per cent. of parasitised eggs of *Dendrolimus remota*, while in a mixed one there were 68 per cent., the count being made from 6,000 eggs in each case. In another investigation the percentage of parasitism in 1,000 eggs of *Dendrolimus remota* was 24–37 and of *D. superans* 61, and in 1,000 pupae of *Dendrolimus remota* 41, of *Zethenia rufescentaria* 31, and of *Caligula japonica* 21.

HAVILAND (M. D.). **On the Life-History and Bionomics of** ***Myzus ribis*****, Linn. (Red-Currant Aphis).**—*Proc. R. Soc. Edinburgh*, xxxix, no. 1, 1918–1919, pp. 78–112, 9 figs. [Received 1st July 1919.]

The red blisters found on red currants (*Ribes rubrum*) are probably caused by the fundatrix stage of *Myzus ribis*. The dimorphic characters of the antenna and of the abdominal and wing dimensions of this Aphid are probably determined by the nature of the food, whether healthy or blistered; the forms from healthy leaves are therefore probably those that have been recognised as *M. whitei*, Theo., and *M. dispar*, Patch, in England and America respectively.

Observations have led to the conclusion that certain Labiatae and other weeds form the summer food-plants of *M. ribis*, this form having been previously described as *Phorodon galeopsidis*, Kalt. The entire life-cycle may be passed on the currant, but if transferred from the summer food-plant back to currant, the Aphids die. The disappearance of the Aphid in the late summer is partly due to the diminished birth-rate and partly to the increase of insect enemies. In the open 4 and 5 generations have been noticed; in laboratories as many as 7.

The principal natural enemy of *M. ribis* is a Braconid, *Aphidius ribis*, Hal., but it does not attack the alate forms. Other enemies are Cecidomyiids, *Chrysopa*, a mite, *Anystis cornigera*, Koch, and a fungus, *Empusa aphidis*.

Spraying as soon as the buds open in April with nicotine solution, paraffin emulsion or soft-soap is advised. All blistered leaves should be picked off where possible and the spray repeated in May. Spraying in October with paraffin jelly is suggested to destroy the sexuales. All weeds such as *Lamium*, *Polygonum* and *Veronica* should be removed from the vicinity of currant bushes.

LEES (A. H.). *Phyllopertha horticola*, **Linn.**—*Gardeners' Chronicle, London*, lixv, no. 1699, 19th July 1919, p. 36, 1 fig.

Phyllopertha horticola, L. (June bug) has been causing great damage to many crops, including wheat, in the neighbourhood of Wisley. The eggs are laid in the ground and the larvae feed on roots of grasses.

The larvae remain 3 years underground causing great damage to turf. Rooks and starlings are predaceous on them. Shaking infested plants in dull weather where possible, when the beetles will readily drop, and spraying with lead arsenate are suggested as remedial measures.

ARROW (G. J.). **Systematic Notes on a few Melolonthine Coleoptera.** —*Annals Mag. Nat. Hist., London*, iv, no. 19, July 1919, pp. 21–29, 1 plate.

These notes include descriptions of *Rhizotrogus gravis*, sp. n., of which larvae were found feeding at the roots of sugar-cane in Mauritius, and *R. rufus*, sp. n., from the Nilgiri Hills, India, in plantations of cinchona seedlings.

BALLOU (H. A.). **The Cotton Worm.**—*Agric. News, Barbados*, xviii, no. 446, 31st May 1919, pp. 170–171.

In consequence of severe attacks of *Alabama argillacea* (cotton worm) in Nevis during the cotton-growing season of 1918, an entomologist visited that Island from the Imperial Department of Agriculture. There was an impression that this moth lives over from one season to another and could be dealt with like the cotton stainer [*Dysdercus*]. It is evident, however, that fresh invasions occur each year from sources outside the Islands, and it has therefore been decided that every effort should be made to induce all growers to provide sufficient insecticides at the beginning of the cotton-growing season and that some method should be devised to compel the application of those measures of control that have been found effective elsewhere in the West Indies.

CROUZAT (L.). **La Pyrale. Sa Destruction.** [The Destruction of *Sparganothis pilleriana*.]—*Rev. Viticulture, Paris*, xlix, no. 1261, 29th August 1918, pp. 131–133. [Received 3rd July 1919.]

The life-history of *Sparganothis pilleriana* on vines in France is summarised and the treatments necessary for its control are reviewed. These include winter treatments with hot water, fumigation with sulphur under a bell-jar of zinc, iron sheeting or tinplates, arsenical sprays and scraping of the bark. The soil about the vines should be well worked in winter to destroy the young larvae that shelter there. Just before blossoming, any leaves that will touch the grapes should be removed, as these afford shelter to the insects before they attack the fruit. In the spring, arsenical sprays should be applied when the larvae ascend the vines and before they have folded over the leaves and taken shelter in them. Heavy dustings with lime have also proved beneficial at this time.

VAYSSIÈRE (P.). **Ravages causés par le *Labidostomis hordei*, F. (Col. Chrysomelidae) dans un Vignoble du Maroc.** [Damage done by *Labidostomis hordei*, F., in a Moroccan Vineyard.]—*Bull. Soc. Entom. France, Paris*, 1919, no. 10, 28th May 1919, pp. 190–191.

On examining a two-year old vineyard in Morocco in April 1919, it was found that the new shoots of the native vines were all damaged

to such an extent that few were likely to recover, while the varieties imported from France, constituting about half the vineyard, were at the time entirely free from attack. It was discovered that the damage was due to the presence in large numbers of a small Chrysomelid beetle, *Labidostomis hordei*, F., the strong mandibles of which are capable of doing great damage to the newly budding shoots. The habits of this species are not well known; it is usually found in pastureland or along the edges of cultivated fields on low-growing plants. It has been recorded previously on *Hordeum murinum* in Barbary and on *Chrysanthemum* growing beside wheat fields in Andalusia, but has never hitherto been observed on vines. Of the nine Moroccan species of *Labidostomis* that have been recorded, *L. taxicornis* is the only one known to damage vines, and then only in Italy and Sicily, where *Salix purpurea* is its usual food-plant. It seems quite possible that *L. hordei* may become one of the most dangerous vine pests in Africa. Arsenical sprays on the young vine shoots are recommended against it.

DE CROMBRUGGHE DE PICQUENDAELE (G.). **Note sur *Pyrausta nubilalis* dans la Banlieue de Bruxelles.**—*Rev. Mens. Soc. Entom., Namur*, xix, no. 4, April 1919, pp. 17–19. [Received 4th July 1919.]

Pyrausta nubilalis, Hb., is abundant in and around Brussels wherever its chief food-plant (*Artemisia vulgaris*) occurs, in spite of remedial measures and cultivation of the soil. The moths are so seldom seen that their appearance was supposed to be merely accidental, but examination has shown that the larvae are widely distributed. The moths generally remain hidden, flying late in the evening and not being attracted to light. As however the larvae are frequently found in the stalks of isolated plants of *Artemisia*, it is probable that they fly freely at night. Another factor that has delayed the discovery of the abundance of this species in the neighbourhood of Brussels is the erroneous opinion that *P. nubilalis* is confined to localities where hops are grown. Various food-plants have been recorded, including hops, maize, hemp, millet, *Inula conyza* and *Phragmites communis*, but few authors have mentioned *Artemisia*. The larvae of *P. nubilalis* have been observed in Bavaria up till April, but in the colder climate of Belgium they occur until early June, pupation then taking place in the stalk or the root of *Artemisia vulgaris*, which seems to be the chief food-plant in that country. In the Netherlands the larva hibernates when mature; in Belgium this occurs before maturity is reached; by mid-August the larva is only half grown, is two-thirds grown by April, and is not mature until the beginning of June. A similar delay in development occurs in other species of the genus *Pyrausta* (*Botys*).

FROGGATT (W. W.). **Some Plant Bugs that infest Citrus Trees.**—*Agric. Gaz. N.S.W., Sydney*, xxx, no. 5, 2nd May 1919, pp. 325–330, 8 figs.

A short account is given of the life-history and food-plants of various bugs infesting *Citrus* in New South Wales, including *Biprorulus bibax* (green-spined orange bug), which has a marked preference for lemon trees, its probable food-plant in the northern districts being

the finger lime (*Citrus australasica*); it is kept in check by a Chalcid parasite. *Stenozygum personatum* (painted capparis bug) is found in all stages among the foliage of wild pomegranate (*Capparis mitchelli*) and also does considerable damage to orange trees. *Agonoscelis rutila* (painted horehound bug) occurs on horehound (*Marrubium*), and although found on orange trees no damage by it has been recorded.

Kerosene or oil emulsion sprayed among the foliage will kill the soft nymphs of these bugs, but for the adults it is suggested to shake the branches, causing the bugs to fall on to a sheet spread out beneath the tree; they can then be easily collected and destroyed.

Hutson (J. C.). **Quarterly Report of the Entomologist. January-March, 1919.**—*Trop. Agriculturist, Peradeniya,* lii, no. 5, May 1919, pp. 276–277.

Several outbreaks of *Icerya purchasi* (fluted scale) have been reported; the remedial measures advocated were the lopping and burning of heavily infested branches, the removal of old and large acacias and encouragement of the local Coccinnellid beetle. The following are among other important pests for which recommendations for control were given: *Zeuzera coffeae* (coffee borer) in tea stems; *Spodoptera mauritia* (paddy cutworm); and an ant, *Dorylus orientalis,* boring in potatoes.

Doten (S. B.). **Report of the Department of Entomology.**—*Ann. Rept. Board of Control for the Fiscal Year ending 30th June 1918, Agric. Expt. Sta., Nevada Univ., Reno,* 1919, pp. 16–18, 2 figs. [Received 7th July 1919.]

Great damage is caused to lucerne in Nevada by the Aphid, *Macrosiphum creeli.* Little is yet known of its life-history. Owing to the honeydew excreted by these insects the leaves become gummed together, which seriously interferes with mowing operations, besides stunting the growth of the crop.

Corn-root Web-worm.—*Wkly. Press Bull., Pennsylvania Dept. Agric., Harrisburg,* iv, no. 24, 19th June 1919, 1 p.

The corn-root web-worm [*Crambus vulvivagellus*] has been reported from various parts of Pennsylvania, causing severe damage to maize when it follows grass in the rotation.

Watch for the new Insect Pest.—*Wkly. Press Bull., Pennsylvania Dept. Agric., Harrisburg,* iv, no. 25, 26th June 1919, 1 p.

The public of Pennsylvania have been warned by means of large posters to keep a careful look out for the European corn borer [*Pyrausta nubilalis*]. Although of wide distribution this moth has not yet been seen in this State, and any suspicious material should be at once reported and sent to the Department of Agriculture.

Cucumber Beetle.—*Wkly. Press Bull., Pennsylvania Dept. Agric., Harrisburg,* iv, no. 25, 26th June 1919, 1 p.

The striped cucumber beetle [*Diabrotica vittata*] has been causing great damage to young cucumber and melon plants in Pennsylvania. Covering the small vines with 2 teaspoonfuls of lead arsenate to 1 U.S. gal. of Bordeaux mixture is suggested as a possible remedial measure. Young plants should be covered with cheese cloth.

Troup (R. S.). **Experiments in the Pollarding of** *Butea frondosa* **for Lac Cultivation.**—*Indian Forester, Allahabad,* xlv, no. 5, 15th May 1919, pp. 223–33, 2 plates. [Received 7th July 1919.]

This paper, which is written from the point of view of the lac cultivator, describes the best methods of pollarding *Butea frondosa,* in order to obtain good broods of this scale-insect [*Tachardia lacca*].

Andrews (E. A.). **Insect Pests of Tea.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* 1919, part 1, 1919, pp. 22–25. [Received 11th July 1919.]

The pests reported on tea during 1918 included *Lachnosterna impressa* (white grub), which attacks the plants in nurseries and to a less degree in the field by cutting the roots. The adults emerge in April and may attack the leaves. As they are attracted by light they may be collected by means of lamps suspended over trays of water or some sticky solution. A smaller cockchafer, *Serica assamensis,* appears about the same time, but the damage it does is confined to a few bushes. Another beetle appearing in April is the orange beetle, *Diapromorpha melanopus.*

Lepidopterous pests include *Andraca bipunctata* (bunch caterpillar) occurring from April to July. *Heterusia magnifica* (red slug) is present in February, March and April, and the female moths can be collected at light in May, June and July. *Clania* spp., *Psyche* spp. and *Acanthopsyche* spp. (bagworms) are active from January to May; the cases should be collected during the cold weather before the contained eggs have hatched. Sprays are of most value from March to April. *Zeuzera coffeae* (red borer) makes its appearance as an adult in May; affected shoots should be cut out in April and immediately burnt. *Thosea cervina* (nettle grub) appears in the adult stage in March and April and the caterpillars in June, and those of the Lymantriids, *Orgyia, Olene* and *Euproctis* from March to May and the moths from May to June. *Arbela* spp. (bark-eating borers) are most easily destroyed during March and April, when they remain 3 or 4 weeks in the pupal stage in the larval boring. *Comocritis pieria* is best dealt with by the destruction of the larval webbing in April. *Gracilaria theivora* (tea leaf-roller) and *Homona menciana* (tea tortrix) are found in the curled tips of the leaves in March, and *Agriophora rhombota* (sandwich caterpillar) occurs from March to May.

Other pests include a cricket (*Brachytrypes portentosus*), against which poisoned bait is the most useful remedy. For *Helopeltis theivora* (tea mosquito) the drenching of tea bushes with lime-sulphur or liver of sulphur solution is suggested. *Empoasca flavescens* is present in all stages by April. *Toxoptera coffeae* (*Ceylonia theaecola*) (tea aphis)

should be treated with soap solution or oil emulsion sprayed from below. *Tetranychus bioculatus* (red spider) and *Eriophyes* (*Phytoptus*) *theae* (pink mite) should be dealt with by spraying with lime-sulphur solution.

CUSHMAN (R. A.). **Descriptions of new North American Ichneumon-Flies.**—*Proc. U.S. Nat. Mus. Washington, D.C.*, lv, no. 2284, 1919, pp. 517–543. [Received 8th July 1919.]

The new parasitic Hymenoptera described in this paper include the Braconid: *Habrobracon politiventris*, sp. n., parasitic on *Polychrosis viteana*, Clem.; and the Ichneumonids: *Chrysopoctonus patruelis*, sp. n., on *Chrysopa* sp.; *Aenoplex polychrosidis*, sp. n., and *Spilocryptus exannulatus*, sp. n., on *Polychrosis viteana*; *Helcostizus rufiscutum*, sp. n., on *Phloeosinus* sp.; *Cryptohelcostizus rufigaster*, gen. et sp. n., on *Chrysobothris mali* and *Agrilus angelicus*; *Glypta mutica*, sp. n., on *Polychrosis viteana*; *Mesoleius balteatus*, sp. n., on *Taxonus* (*Amestastegia*) *glabratus*, Fall.

WHITE (G. F.). **Nosema-Disease.**—*U. S. Dept. Agric., Washington D.C.*, Bull. no. 780, 12th June 1919, 59 pp., 4 plates, 7 figs.

Full particulars are given concerning the cause, symptoms, modes of transmission, diagnosis and prognosis of Nosema disease in bees, with the results of experiments made to determine the resistance of *Nosema apis* to heating, drying, fermentation, putrefaction, direct sunlight and carbolic acid.

The following is the author's summary: (1) Nosema-disease is an infectious disorder of adult bees caused by *Nosema apis.* (2) The disease is not particularly malignant in character, being in this respect more like sacbrood than the foulbroods. (3) Adult workers, drones, and queens are susceptible to infection, but the brood is not. (4) The infecting agent, *Nosema apis*, is a Protozoan that attacks the walls of the stomach and occasionally those of the Malpighian tubules. (5) A colony can be inoculated by feeding it with syrup containing the crushed stomachs of infected bees. (6) One-tenth of the germs present in a single stomach are sufficient to produce marked infection in a colony. (7) Within a week following the inoculation, the parasite can be found within the walls of the stomach. (8) Before the close of the second week infection can be determined by the gross appearance of the organ. (9) The disease can be produced at any season of the year by feeding inoculations. (10) Infected bees may be found at all seasons of the year, the highest percentage of infection occurring in the spring. (11) Nosema infection among bees occurs at least in Australia, Switzerland, Germany, Denmark, England, Canada and the United States. This distribution shows that the occurrence of the disease is not dependent altogether upon climatic conditions. (12) The course of the disease is not affected directly by the character or quantity of food obtained and used by the bees. (13) A sluggish body of water, if near an apiary and used by bees as a water supply, and the robbing of diseased colonies, must be considered for the present as two probable sources of infection. (14) The transmission of the disease through the medium of flowers is not to be feared. (15) The hands and clothing of the apiarist, the tools

used about the apiary, and winds need not be feared as means by which the disease is spread. (16) Hives which have housed infected colonies need not be disinfected and combs from such colonies are not a likely means for the transmission of the disease. (17) Bees dead of the disease about the apiary are not likely to cause infection unless they serve to contaminate the water supply. (18) *Nosema apis* suspended in water is destroyed by heating for 10 minutes at about 136° F. (58° C.). (19) Suspended in honey, *Nosema apis* is destroyed by heating at about 138° F. (59° C.). (20) *Nosema apis*, drying at room and outdoor temperatures, respectively, remained virulent for about 2 months, at incubator temperature about 3 weeks, and in a refrigerator about 7½ months. (21) *Nosema apis* was destroyed in the presence of fermentative processes in a 20 per cent. honey solution in 3 days at incubator temperature and in 9 days at outdoor temperature. In a 10 per cent. sugar solution it was destroyed in from 7 to 11 days at room temperature. (22) *Nosema apis* resisted putrefactive processes for 5 days at incubator temperature, for 2 weeks at room temperature, and for more than 3 weeks at outdoor temperature. (23) *Nosema apis* when dry was destroyed in from 15 to 32 hours by direct exposure to the sun's rays. (24) *Nosema apis* suspended in water was destroyed by exposure to the sun's rays in from 37 to 51 hours. (25) *Nosema apis* if suspended in honey and exposed to the sun's rays frequently will be destroyed on account of the temperature of the honey which results from the exposure. (26) *Nosema apis* remained virulent in honey for from 2 to 4 months at room temperature. (27) *Nosema apis* in the bodies of dead bees ceased to be virulent in one week at incubator temperature, in 4 weeks at room temperature, in 6 weeks at outdoor temperature, and in 4 months in a refrigerator. (28) *Nosema apis* in the bodies of dead bees lying on the soil ceased to be virulent in from 44 to 71 days. (29) *Nosema apis* is readily destroyed by carbolic acid, a 1 per cent. aqueous solution destroying it in less than 10 minutes. (30) The time element which by the experiments is shown to be sufficient for the destruction of *Nosema apis* should be increased somewhat to insure their destruction in practical apiculture. (31) The prognosis in Nosema-disease varies markedly from excellent, in case of strong colonies with a comparatively small percentage of Nosema-infected bees, to very grave, in case of weak ones with a high percentage of infected bees. (32) From a technical point of view the results here given must be considered as being approximate only. They are, however, in most instances sufficient for practical purposes.

CRAIGHEAD (F. C.). **Protection from the Locust Borer.**—*U.S. Dept. Agric. Washington, D.C.*, Bull. no. 787, 9th June 1919, 12 pp., 3 plates.

Instructions are given for the prevention of attacks on locust trees (*Robinia pseudacacia*) by the Longicorn beetle, *Cyllene robiniae*, Forst. (locust borer).

Details are also given to aid in the determination of infested trees. As a remedial measure the following spray is advocated: ¼ lb. of either sodium arsenite or sodium arsenate dissolved in 5 U.S. gals. of water, to which 1 U.S. qt. of miscible oil is added, the whole being well

mixed. An alternative spray is ¼ lb. of the arsenical in 4 U.S. gals. of water with the addition of 1 U.S. gal. of stock solution of kerosene emulsion.

Particulars of various investigations are given, during which it was found that the denser the growth, particularly weeds and undergrowth round the stem of the tree, the less was the amount of infestation.

SATTERTHWAIT (A. F.). **How to control Billbugs destructive to Cereal and Forage Crops.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 1003, January 1919, 23 pp., 24 figs. [Received 8th July 1919.]

A great deal of damage is done to cultivated grasses and cereals in the United States by various weevils of the genus *Sphenophorus*. The damage is most marked in fields nearest to reclaimed swamp land and marshes. Deformity is caused to the plants in two ways; either the punctured leaves interfere with the growth of the succeeding ones, or when the injury is low down in the stalk sprouting or suckering may be the result. The young grubs may also cause injury by feeding on the roots.

The following species are dealt with: *Sphenophorus parvulus*, Gyll. (blue-grass billbug) injures timothy, blue grass, wheat, oats, barley and rye. The grub excavates the stem for about 3 inches at the base or it may eat the root and fibres. Pupation takes place in the corms of timothy grass or in the soil. When attacking rye the grub eats the substance of the stem up to the second joint, passing from there to the roots. The larval and pupal stages average about 23 and 8 days respectively. The entire period from egg to adult is about 45 days. Submergence for several days in water does not injure this species.

Sphenophorus zeae, Walsh (corn billbug) very much resembles *S. parvulus* in its habits and life-history. The whole cycle from the egg to the adult is about 52 days, the egg-stage lasting about 9 days, the larval stage 38, and the pupal about a week.

S. aequalis, Gyll. (clay-coloured billbug) is a swamp-inhabiting species. In Illinois and Indiana eggs are laid in the stalk about 4 inches above the young bulb, from May to August. The grubs bore down the stem to the old bulbs, where pupation takes place within the larval excavation, the adults emerging about 21st August, but remaining in the pupal cell during the winter and appearing above ground in the spring. Injury by this species generally results in death of the plant. Adults have been found feeding on maize, millet, foxtail (*Chaetochloa* spp.), the bullrushes (*Scirpus atrovirens* and *S. fluviatilis*), *Cyperus strigosus* and *Phragmites*.

S. maidis, Chitt. (maize billbug) injures maize by piercing the stem and eating the tissue and also by excavating the stalk at or below the soil surface for oviposition. After 7 to 12 days the grubs appear feeding on the stalk and main root, in the upper part of which they pupate after about 40 to 50 days. The pupal period lasts about 10 to 12 days. The injury dwarfs and sometimes kills the plant. This pest is active from June to September, oviposition taking place in June. The early developing adults migrate for hibernation elsewhere, but those maturing later remain in the larval excavations,

where they may be destroyed by carefully pulling up and burning the plant, roots and all.

S. callosus, Ol. (curlew bug) sometimes causes the destruction of entire maize fields, most of the injury being caused by the feeding of the grubs in the base of the stalk and tap-root. Eggs are laid in maize, *Cyperus esculentus*, *C. strigosus*, *C. rotundus* and probably in a good many other plants. They are laid in the stalk either under the soil or within an inch above the surface. During the egg-laying season the adults rest under clods of earth. The egg-stage lasts 4 to 12 days, the larval stage from less than 39 days in midsummer to more than 71 days in the autumn, development being quicker with abundance of food. Pupation requires about 6 to 8 days. Hand pulling is useless as a remedial measure as the tip of the root containing the beetle often breaks off and remains in the ground.

S. discolor, Mann., is not very destructive unless barley, oats or wheat are planted very near marshes containing tule (*Scirpus occidentalis*). The damage is caused by the adults in the spring. It is not known to breed in cultivated crops, and as only one season is required for its development, clean cultivation for one year will eliminate it.

S. pertinax, Ol. (cat-tail billbug) is extensively destructive to growing maize, of which it attacks the stalk from below the ground surface, causing dwarfing of the plant. The adults are active from April to August and hide in the soil. Eggs are laid in June about cat-tail and other reeds. Hibernation probably takes place in the pupal stage.

S. destructor, Chitt., the adults of which are known to live nearly a year, one female laying at least 30 eggs, is frequently found in the same field as *S. callosus*, its food-plants being similar.

S. venatus, Say, is destructive to timothy and maize. The habits of the grub are little known, but it develops in wheat and timothy. The adult injures wheat and maize, its activity lasting from April to August or later.

S. phoeniciensis, Chitt., attacks the tender stools of wheat and barley in the spring, the injury not being noticed until it is too late to restore the crop, but prompt irrigation may save a part by stimulating growth. The damage continues until June and may even occur in the warm winter months. Oviposition takes place in the punctured tips of plants. The injury caused by this pest in wheat or barley may amount to 100 per cent. The life-cycle from egg to adult requires about 2 months; the eggs laid in March and April hatch in about 8 to 12 days; those laid in May in 6 to 8 days. Pupation takes place in earthern cells in the soil.

S. minimus, Hart (little billbug) works beneath the surface, the damage done being consequently difficult to ascertain. Its food-plants include timothy, quick grass and wild rye (*Elymus virginicus*). The egg-period is less than 8 days, the larval stage 27–33 days and the pupal 7 or more days. The entire development requires from 60 to 70 days.

The natural enemies of these weevils include fungus parasites, toads, insectivorous birds, etc. A Hymenopterous parasite, *Zavipio elfrigei*, Cress., has been bred from *S. callosus*.

Clean cultivation, autumn-ploughing, rotation of crops and improved drainage are suggested as the best remedial measures. In the case

of *S. phoeniciensis*, which cannot complete its life-cycle on wheat or barley, the removal of all grasses from the neighbourhood of these fields will reduce its numbers, or potatoes or cotton are suggested as alternative crops.

Ainslie (G. G.). **The larger Corn-Stalk Borer.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1025, February 1919, 12 pp., 8 figs. [Received 8th July 1919.]

Much of the damage due to *Diatraea zeacolella*, Dyar, was previously attributed to *D. saccharalis crambidoides*, F., which it greatly resembles in life-history and habits, except that the latter feeds on maize and sugar-cane indiscriminately, whereas *D. zeacolella* rarely attacks sugar-cane [see this *Review*, Ser. A, iii, p. 184]. The eggs hatch in about 7 to 10 days and give rise to the larvae of the first generation of the season, being laid in batches of 2 to 25 about May on the under-side of leaves. The larvae begin feeding on the leaves, descending later to the stalk, where they attain full growth and pupate usually in the second or third joint from the ground. The larval stage lasts 20 to 30 days, pupation requiring from 7 to 10 days. The second generation, of which the eggs are laid in similar positions on the lower leaves or stem, hibernates in the larval stage in the extreme lower tip of the tap-root below the ground.

The natural enemies of this moth include an egg parasite, *Trichogramma minutum* (*pretiosum*, Riley), and *Chauliognathus pennsylvanicus*, De G., as well as an undetermined fungus. Remedial measures suggested are crop rotation and clean cultivation, including the destruction or ploughing under deeply of the maize roots containing the hibernating larvae.

Byars (L. P.). **The Eelworm Disease of Wheat and its Control.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 1041, March 1919, 10 pp., 10 figs. [Received 8th July 1919.]

The disease caused by the Nematode, *Tylenchus tritici*, has been causing a great deal of damage to wheat in the United States, especially in Virginia [see this *Review*, Ser. A, vii, p. 324]. Diseased plants are recognised by a marked wrinkling, rolling and distortion of the upper leaves. The plants either die or produce dwarfed, diseased heads. As the plant becomes ripe, the larvae become dried out and motionless, in which condition they can remain alive for many years.

This eelworm was probably introduced with imported seed from foreign countries, and can easily be spread by the interchange of seed; it can also be carried by means of infested soil clinging to the feet of men and animals or to farm implements. Surface waters that may carry galls or free Nematodes should not be allowed to pass from infested territory to uninfested areas. All infested land should be planted with crops other than wheat for 2 or 3 years; by this time the Nematode should be starved out, as it is not known to attack seriously any other crop.

Seed can be rendered free from galls by pouring it slowly into a solution of 40 lb. of common salt dissolved in 25 U.S. gals. of water, making a 20 per cent. salt solution; this should be vigorously stirred, when the sound grain will sink and the galls, light kernels and trash

can be easily skimmed off. The galls after rinsing and plunging into hot water may be given to poultry, and even if thrown away must be treated with hot water to ensure the death of the Nematodes. The sound grain should be well rinsed immediately to prevent injury to germination, and then spread on canvas to dry. Care must be taken to prevent freezing of the wet grain. The salt solution may be used again, but should be kept well away from stock and poultry.

The "17-Year Locust" in 1919.—*U.S. Dept. Agric., Washington, D.C.*, Circ. 127, 5th April 1919, 11 pp. [Received 8th July 1919.]

It is believed that the swarm of the 17-year locusts [*Tibicen septemdecim*] predicted to appear from the last week in May to the first week in June of 1919 will be unusually large, its range including the whole or portions of 20 States. Brood 18 of the race with a 13-year cycle is expected to be smaller, only 5 States being affected. The damage caused by this cicada is comparatively small, as it eats very little, its principal food consisting of small quantities of plant juices. The chief damage is done by the slits made by the female in the tender branches of trees for oviposition. Of forest trees, oak and hickory seem to be preferred for this purpose; pines, cedars and other species that exude gummy substances are avoided. In orchards, apples, peaches and pears are preferred, but all other trees may be attacked. The injury is only serious where young trees are concerned, for which preventive measures are suggested [see this *Review*, Ser. A, v, p. 369].

Burke (H. E.). **Notes on a Cocoon-making Colydiid (Coleopt.).**—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 6, June 1919, pp. 123–124.

Deretaphrus oregonensis, Horn, which is parasitic on a number of wood-boring beetles, probably has a life-cycle of two or more years and hibernates in the adult form in a cocoon. It has been recorded from various districts in California parasitising *Trachykele opulenta*, Fall, in living incense cedar (*Libocedrus decurrens*) and *T. nimbosa* in red fir (*Abies magnifica*), *Dendroctonus jeffreyi*, Hopk., in dead Jeffrey pine (*Pinus jeffreyi*), *D. monticolae*, Hopk., *Buprestis laeviventris*, Lec., and *B. aurulenta*, L., on dead sugar pine (*P. lambertiana*), and in the pupal cell of a Cerambycid in lodge-pole pine (*P. murrayana*).

Burke (H. E.). **Notes on the California Oak Worm, *Phryganidia californica* (Lepid.).**—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 6, June 1919, pp. 124–125.

Phryganidia californica lays its eggs partly on deciduous oak (*Quercus lobata*) and partly on the live oak (*Quercus agrifolia*). Those laid on the former rarely reach maturity owing to the leaves falling and becoming unfit for food unless the winter is very mild.

The principal natural enemies of this moth are a wilt disease; *Podisus maculiventris*, Say (spined soldier bug), which sucks the eggs as well as both the larval and pupal stages; a small fly, *Thryptocera flavipes*, Coq., which attacks the large larvae; and the Hymenopterous parasites, *Chalcis abiesiae*, Gir., and *Itoplectis behrensi*, Cress., which infest the pupae.

Busck (A.). A Microlepidopteron injurious to Avocado.—*Proc. Entom. Soc. Washington, D.C.*, xxi, no. 6, June 1919, pp. 125–126.

The larva of *Stenoma catenifer*, Wlsm., is described. This moth is reported to be injurious to avocado fruit and seed in Guatemala and Ecuador. The galleries made by the caterpillar in the seed are similar to those made by the large avocado weevils. The eggs are laid on the surface of the nearly ripe fruit of *Persea* spp. and the emerging larvae eat through to the seed where they remain 3 or 4 weeks, when they again eat their way through the flesh to pupate.

In Ecuador it is almost impossible to buy uninfested fruit, and this moth might become a dangerous pest if introduced into the United States.

Stearns (L. A.). The Oriental Fruit Moth in Virginia: A Preliminary Report.—Separate from *Qtrly. Bull. Virginia State Crop Pest Commiss., Blacksburg*, i, no. 1 [n. d.], 5 pp., 1 plate. [Received 9th July 1919.]

The bulk of the information contained in this paper on *Cydia molesta* has previously been noticed [see this *Review*, Ser. A, vii, p. 207, etc.].

Mitchell (J. D.). U.S. Bur. Entom. **Notes on *Diacrisia virginica*, (Lep.)**—*Entom. News, Philadelphia*, xxx, no. 7, July 1919, pp. 191–194.

Larvae of *Diacrisia virginica* were observed in July 1917 in Texas in limited numbers, feeding on various species of weeds. In one locality, cotton fields were attacked and the plants were defoliated, leaving the green bolls on the stalks. These larvae pupated in August, and during the autumn passed unnoticed owing to extreme drought and the presence of *Alabama argillacea* (cotton leafworm). In May of 1918 severe infestations appeared in several counties, much damage being done to cotton. A list of food-plants on which the larvae were found is given; this includes many weeds, as well as cultivated crops such as cotton, maize, cantaloup, lucerne and peanut. Many garden plants are also attacked. The cultivated fields appeared to be attacked only when weeds were scarce. When the caterpillars are very young, 3 lb. of Paris green and 5 lb. lime made into 50 U.S. gals. of spray will kill them; but when they are large, no poisons or repellents seem to have any effect upon them. Various remedial measures have been reported to give some success; dusting the fields with pure Paris green before the caterpillars reached them is said to act as a deterrent; hand-picking and killing the caterpillars along the side of the field nearest to infestation proved practicable until August and was of some value; the caterpillars do not feed fast nor do they travel all in the same direction as most army worms do.

From May until mid-October five fairly well-marked generations were observed, although from August on to the end of the season all sizes of caterpillars could be found. During early November a great number of caterpillars died of a fungus disease due to *Entomophthora anticae*, Reich. Those that survived spun cocoons under rubbish,

dead leaves or clumps of earth, frequently 20 or 30 together. The adults generally emerge in the night, and sometimes pair on the following day and oviposit on the 2nd or 3rd day. The usual length of life of captive moths is about five days.

The damage done by *D. virginica* in some localities was claimed by farmers to be from 25 per cent. to total destruction. The only parasite bred from this moth is an Ichneumonid, *Eremotylus arctiae*, Ashm.

BAKER (A. C.). U.S. Bur. Entom. **A *Melaphis* from Moss (Hom.).**—*Entom. News, Philadelphia*, xxx, no. 7, July 1919, pp. 194–196, 1 fig.

The only American species hitherto recorded in the genus *Melaphis* is the type species, *M. rhois*, Fitch, which produces galls on sumach. Certain closely related species, forming galls on sumach in other countries, have been referred to the genus *Schlectendalia*, which is considered a synonym. The galls formed by these species are autumn galls, not spring ones like those usually produced on poplar, etc., by species of *Pemphigus* and other Aphids. In April 1916, moss was found in Virginia infested with young apterous forms of an Aphid. It is probable that these were produced by stem-mothers originally present, but no such forms were found. The moss was placed in breeding-cages and the young insects reared to maturity. All the mature insects were winged and were unable to live upon the moss. Upon careful examination, these seemed to belong to the genus *Melaphis*. Had this been discovered in time, transfers to sumach would have been made to determine whether these might be the long-missing spring migrants of *M. rhois*, but by the time the examination was made all the alate insects were dead. They differed distinctly from *M. rhois*, but a connection with that species is possible and would have been worthy of a trial. The insect is here described under the name *Melaphis minutus*, sp. n., and it is hoped that further opportunities for studying its life-history may occur.

SWAINE (J. M.). **Tent Caterpillars.**—*Dept. Agric. Domin. Canada*, Entom. Branch, Circ. no. 1 (Revised Edition), 21st September 1918, 12 pp., 8 figs. [Received 15th July 1919.]

The bulk of the information in this circular on *Malacosoma* spp. has previously been noted [see this *Review*, Ser. A, i, p. 231]. In 1912 outbreaks of bacterial and fungous diseases were noticed which later proved effective in controlling the caterpillars.

Lead arsenate may be used as a spray at the rate of 3 lb. to 40 U.S. gals. of water, but if used in the powdered form only half as much of the poison is needed.

DENDY (A.). **Report on the Effect of Air-tight Storage upon Grain Insects. Part I.**—*Rept. Grain Pests (War) Committee, Royal Society, London*, no. 1, 1919, pp. 6–24.

It is concluded from experiments described in this paper with regard to *Calandra granaria*, *C. oryzae* and *Silvanus surinamensis*

that hermetical sealing will probably prove to be effective on a large scale as a remedy for badly weeviled grain, as well as a preventive measure.

This has subsequently been confirmed [see this *Review*, Ser. A, vii, p. 94]. The carbon dioxide given off by the grain as well as by the weevils themselves acts as a narcotic on the weevils, eventually killing them, but exercises no detrimental effect on the grain unless it is stored for longer than two years, when its germinating power becomes affected. The time taken to bring about the complete destruction of the insects seems to depend chiefly upon the relative volume of air present.

EDKINS (J. S.) & TWEEDY (N.). **Report on the Effect of various Gaseous Reagents upon the Flour Moth (*Ephestia kühniella*) and other Pests found in Flour.**—*Rept. Grain Pest (War) Committee, Royal Society, London*, no. 4, April 1919, pp. 3–13. [Received 17th July 1919.]

Experiments, directed chiefly against *Ephestia kühniella*, but including *Tribolium castaneum*, *T. confusum*, *Gnathocerus cornutus*, *Laemophloeus pusillus* and *Tenebroides mauretanicus*, were made with various gaseous reagents, of which formaldehyde was not effective; 1 per cent. sulphur dioxide killed all stages of *Ephestia* in half an hour, but rendered the flour useless for bread-making; 5 per cent. ammonia had no effect on beetles or larvae; ether sprayed by an atomizer anaesthetised the insects; methylated spirit did not give immediate results, but all life was extinct by the next day.

Ozonised air containing 100 parts of ozone per million killed the moths after two exposures of from 7 to 8 hours each, 50 parts per million in dry air tended to destroy the moths but not the larvae. Although these are not destroyed, they are unable to continue development. The apparatus used for this experiment is described. As 5 parts of ozone per million is injurious to human life this treatment would have to be carried out in closed circuits.

DENDY (A.) & ELKINGTON (H. D.). **On the Phenomenon known as "Webbing" in stored Grain.**—*Rept. Grain Pest (War) Committee, Royal Society, London*, no. 4, April 1919, pp. 14–17. [Received 17th July 1919.]

This phenomenon which was formerly considered to be to some extent evidence that the grain beneath it was in good condition has now been proved to be the result of the wanderings of thousands of larvae of the flour moth, *Ephestia elutella*, over the grain. As *Ephestia elutella* is only one of many insects capable of producing such a web, all similar conditions cannot however be attributed to this pest. The damage done by the larvae consists in eating out the germ from the stored grain and fouling it by faecal products and other débris. The former injury is not very serious, as it takes place almost entirely within 12 inches of the surface of the heap, and the latter would be removed in theordinary cleaning process towhich all wheat is subjected. There is slight evidence of the web serving as a trap for weevils.

DENDY (A.). **Note on the Occurrence of live Insects in Tins supposed to be hermetically sealed.**—*Rept. Grain Pest (War) Committee, Royal Society, London,* no. 4, April 1919, pp. 18–20. [Received 17th July 1919.]

It has now been definitely proved by experiments that no insects can remain alive in really air-tight tins after the oxygen, originally present, has been used up. The apparent failure of this treatment with regard to army biscuits [see this *Review*, Ser. A, i, p. 292 and vii, p. 94] was probably due to some slight leakage of the tin. This should be guarded against by careful testing of the tins before they are put into storage, which in the case of small tins can be done by the hot water method.

FULLAWAY (D.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xvi, no. 5, May 1919, pp. 132–133.

During April the insectary handled 7,500 pupae of the melon fly [*Dacus cucurbitae*], from which were bred 495 females and 300 males of *Opius fletcheri.*

The parasites distributed were :—*Opius fletcheri,* 1,120 ; *O. humilis,* 845 ; *Diachasma tryoni,* 295 ; *D. fullawayi,* 160 ; *Tetrastichus giffardianus,* 1,750 ; *Dirhinus giffardi,* 230 ; *Galesus silvestrii,* 400 ; *Spalangia cameroni,* 950 ; and *Paranagrus osborni,* 22,500.

DUFRENOY (J.). **Sur les Maladies parasitaires des Chenilles processionnaires des Pins d'Arcachon.** [Parasitic Diseases of the Processionary Caterpillars of Pines in Arcachon.]—*C.R. hebdom. Acad. Sci., Paris,* clxviii, no. 26, 30th June 1919, pp. 1345–1346.

As the result of observations made with destructive bacteria and muscardine fungi on *Cnethocampa pityocampa, Beauveria* spp. were found to have the most virulent effect on this moth. After contact with culture spores the caterpillars of *C. pityocampa* and the adults and eggs of *Melolontha melolontha* (*vulgaris*) mummified in a few days, but the caterpillars of *Cossus cossus* (*ligniperda*) remained alive for 3 weeks.

MARRE (F.). **Les Animaux nuisibles au Blé en Cours de Végétation.** [Animals injurious to growing Wheat.]—*Jl. d'Agric. Pratique, Paris,* xxxii, nos. 22 and 24, 3rd and 17th July 1919, pp. 450–451 and 493–494.

Among the insects recorded as injurious to growing wheat in France is the beetle, *Saperda marginella,* which oviposits at the base of the spikes, where the larva constructs a circular gallery, the head being thus cut off. The larvae then descend to within about 2 inches of the ground, where they hibernate as pupae. The wheat should therefore be cut very low and the stubble torn up or burnt directly after the harvest. *Zabrus* sp. appears in summer and attacks the young tender grain. Eggs are laid at the base of the wheat between lumps of earth and the larvae live for 2 or 3 years, attacking the green stalks and leaves. The only remedy against this beetle, which is found chiefly in the north and east of France, is rotation of crops ; oats are not attacked by it. The Elaterid, *Agriotes lineatus* (*Elater segetis*)

attacks the crown of the plant and mines the interior. Injections of carbon bisulphide have been recommended, but this treatment is not very practicable. Rotation of crops is almost useless, as this wireworm attacks nearly all plants. The use of cakes of rape-oil dug into the ground in autumn has been advocated, but birds and moles seem to be the only effective check. *Macrosiphum* (*Aphis*) *granarium* feeds on the stalks and thrips appear on wheat in June, but neither of these is an important pest.

The Hessian fly [*Mayetiola destructor*] is a dangerous pest from April onwards; from three to six generations occur in a season. The early destruction of stubble that harbours many pupae is advised; rotation of crops has not given good results, but bearded varieties of wheat are more resistant to attack. A smaller Cecidomyid, *Contarinia* (*Diplosis*) *tritici*, appears at the moment of blossoming and oviposits on the spikes. The larvae enter the glumes and devour the blossoms, preventing the formation of the grain. In July the larvae descend to the ground, where they pupate and pass the winter, the adults emerging in the following June. Remedial measures are almost unknown; the lighting at night of fires into which the adults fly, and the turning over of the top soil to expose the nymphs have been advocated. Bearded varieties are some protection against oviposition; rotation of crops should be successful, as this species seldom attacks anything but wheat.

Chlorops lineola is another harmful Dipteron, oviposition occurring at the base of the spikes towards the end of May. The larvae hatch in a fortnight and descend by mining the stalks to the first node, where they pupate. Adults emerge in September and oviposit on the stalks, and the larvae descend down the stem of the plant, causing swellings at the base of the stalks, and finally hibernate in the nymphal stage. In infested wheat, the ear seldom succeeds in extricating itself from the leaves and remains green longer than the healthy plants. Such plants are easily detected and should be uprooted and destroyed. Rotation of crops is recommended. An allied species, *Chlorops herpini*, only attacks barley.

Hymenopterous pests include *Cephus pygmaeus*, which oviposits below the spike, the larva descending to a few inches above the ground, where it constructs a circular gallery, weakening the plant and hindering its nutrition so that very few ears mature. Pupation occurs below ground, where the winter is passed. Burning the stubble is the only efficacious remedy.

THEOBALD (F. V.). **New and little known British Aphides.**—*Entomologist, London*, lii, no. 674, July 1919, pp. 157–161.

The following species are dealt with:—*Myzus gei*, sp. n., alate females of which were found under leaves of *Geum urbanum*, surrounded by small green larvae; *Myzus mercurialis*, sp. n., found in abundance on *Mercurialis officinalis* in the spring; *M. galiifolium*, sp. n., living in dense clusters on the top shoots of bedstraw (*Galium cruciatum*); *Aphis abrotaniella*, sp. n., taken on *Artemisia abrotani*; *Macrosiphum solanifolii*, Ashm., which oviposits on roses in the autumn, the alate forms migrating to potatoes in June and July; and *Myzus solani*, Kalt., very abundant and causing damage to

potatoes. Other Aphids occurring in England on potatoes are:—*Rhopalosiphum dianthi*, Schr., *R. tuberosellae*, Theo., and *Aphis solanina*, Pass. *Aphis silybi*, Pass., has been reported once from Cornwall.

Aphids taken on Douglas fir in Surrey are probably referable to *Chermes cooleyi* var. *cowani*, Gill., but were too much damaged for definite identification.

SWAIN (A. F.). **New Aphididae from California.**—*Trans. Amer. Entom. Soc., Philadelphia*, xliv, no. 1, March 1918, pp. 1–23, 2 plates. [Received 4th June 1919.]

The following new species are described from California: *Myzocallis davidsoni*, previously considered to be *Calaphis castaneae*, Fitch, but now proved to be distinct from this species, was found on *Quercus pedunculata* and various species of chestnut. The alate stem-mothers appear in the late spring and give rise, parthenogenetically, to alate and apterous oviparous females throughout the summer. The sexual forms appear in October and November, the males being alate and the oviparous females apterous. The eggs are laid in October and November on the bases of the buds, roughened parts of the bark of branches and on the trunks of the trees.

Myzocallis maureri was taken from the under-side of leaves of the coast live oak (*Quercus agrifolia*) in June and July; it has also been found in March and April. Only oviparous females and nymphs have so far been taken. In certain districts this species is only found on black oak (*Quercus kelloggi*), although *Quercus agrifolia* may be growing side by side with it.

Symydobius chrysolepis was found in April encircling a terminal twig and leaf-petiole of maul oak (*Quercus chrysolepis*), on which only apterous oviparous females were noticed, though several alate individuals appeared later in the colonies removed to the laboratory. This species has only been placed in this genus provisionally owing to its resemblance to *S. albisiphus*, Davis, the main points of difference being given in a table. A considerable number of Chalcid parasites, *Closterocerus utahensis*, Craw., var. *californicus*, Gir., emerged from the apterous individuals.

Alate and apterous oiviparous females of *Nectarosiphon morrisoni* were taken from twigs of Monterey cypress (*Cupressus macrocarpa*) in May; in August apterous forms were also found on blue cypress (*C. guadalupensis*).

Lachnus ferrisi, previously recorded as *L. abietis*, Fitch, was found infesting trunks of young pine trees (*Pinus* sp.) in September.

L. taxifolia is a bark feeder and is found on the older growths of the small limbs and on trunks of young trees in the spring, early summer and also in August, its food-plant being Douglas fir (*Pseudotsuga taxifolia*). A table is given showing the characters distinguishing this species and *L. pseudotsugae*, Wilson.

Aphis ramona, found in April and August attacking black sage (*Ramona stachyoides*), is more or less heavily parasitised and is attended by ants to a considerable extent.

Aphis senecio attacks a great variety of food-plants, a list of which is given, the majority being composites. In the winter in Southern

California it is chiefly found on asters and marigolds, but disappears during the hot weather until the autumn. The alate forms are in the majority in January and February, the apterous forms appearing later.

Cerosipha cupressi was found infesting blue cypress (*Cupressus guadalupensis*) in April and in August, also Monterey cypress (*C. macrocarpa*). The apterous forms were found singly at the base of terminal leaves. Alate forms could only be obtained by placing branches in closed receptacles, a fact that suggests migration to some other host.

VAN HALL (C. J. J.). **Ziekten en Plagen der Cultuurgewassen in Nederlandsch-Indië in 1918.** [Diseases and Pests of Cultivated Plants in the Dutch East Indies in 1918.]—*Meded. Laboratorium voor Plantenziekten, Buitenzorg,* no. 36, February 1919, 49 pp. [Received 16th June 1919.]

On the whole, insect injury was not considerable in 1918. As in previous years a Coccinellid, *Epilachna* sp., sometimes did much damage to potatoes. On the west coast of Sumatra this pest was of less general occurrence at altitudes of and above 6,000 feet. *Arachis* [*hypogaea*] was again attacked in certain localities by a Typhlocybid leaf-hopper and sweet potatoes were infested with a weevil, *Cylas turcipennis.* Teak was damaged by a termite, *Calotermes tectonae,* and a Cossid borer, *Duomitus ceramicus*; the latter was originally called the teak canker caterpillar because the more widely known injury caused by it occurs on small stems and gives rise to a swelling. The mines are also found, however, in thick trunks. The actual boring appears to take place in the cambium and outer sap-wood, and there is a very short gallery in the wood itself. In Java, woodpeckers and a Tachinid fly are the natural enemies of this borer.

Zeuzera coffeae attacked mahogany, *Cedrela sinensis, C. febrifuga, Schleichera trijuga, Phyllanthus emblica, Adenanthera microsperma, Vitex pubescens* and teak. The larva of *Z. postexcisa* was found in wild trees. An apparently unknown species of *Xyleborus* was found in teak. The injury done to mahogany by a small species of *Xyleborus* is becoming serious; the parts affected are the main root and the lower part of the stem. The chief damage is done in nurseries, but many one-year-old plants also are destroyed. Many complaints were also received about the mahogany twig borer. The ring borer, *Phassus damor,* which injured cinchona in 1917, has now attacked other plants. Cinnamon was injured by a leaf-mining caterpillar. Leaf caterpillars also attacked *Cassia fistula, C. javanica* and *C. siamea.* The caterpillars of *Trabala vishnu* and *Ophiusa coronata* infested *Terminalia belerica.* A weevil, *Rhinoscapha amicta,* destroyed 20 per cent. of the cultivated *Cupressus* trees in one district by gnawing the bark. *Pseudococcus virgatus* and other scales were favoured by the dry East Monsoon.

Cacao was rather severely attacked by the cacao moth [*Acrocercops cramerella*], but injury by *Helopeltis* decreased. *Zeuzera coffeae* and other borers occurred in cacao.

Cassava was injured by mites, chiefly in dry districts. During the prolonged dry weather gambir [*Uncaria*] was severely attacked by plant-bugs and caterpillars. On one estate in West Java *Hevea*

rubber was infested with *Coptotermes gestroi*. Kedelé [*Glycine soja*] was attacked by Agromyzid borers, 70 per cent. of the crop being lost in one case, and by *Epilachna* sp., which has not been recorded hitherto from this plant.

Cinchona pests included *Helopeltis antonii*, *Euproctis flexuosa* and *Miresa nitens*. In the previous report [see this *Review*, Ser. A, vi, p. 349] it was stated that *Tetranychus telarius* was more dangerous than the other two mites, *Tarsonemus translucens* and *Brevipalpus obovatus*, infesting cinchona. This is confirmed and the further spread of *T. telarius* is recorded. Dusting with sulphur is said to be entirely efficacious provided applications are made early and continued regularly.

Coconuts still suffered from the infestation with *Brachartona catoxantha* which began in 1917. The measures against *Oryctes* [*rhinoceros*] gave good results. Other beetle pests were *Rhynchophorus* [*ferrugineus*], *Mellisoblaptes* [*rufovenalis*], Hispids and *Brontispa*. Owing to the dry weather the Hesperid butterfly, *Hidari irava*, did much harm, especially in young plantations. A scale-insect also occurred on coconut.

Coffee was infested by *Pseudococcus virgatus*, and on a few estates an attempt was made to combat it with the help of the Coccinellid, *Cryptolaemus montrouzieri*, imported from Hawaii by van der Goot, whose trapping system was employed with great success against the gramang ant [*Plagiolepis longipes*], thus reducing the green scale [*Coccus viridis*] in many plantations. Other coffee pests included *Tylenchus* sp., *Xyleborus coffeae* and *Stephanoderes hampei*. Some stored coffee of the 1916 crop was infested with *Araecerus* sp.; this coffee had a water-content of 10·5 per cent.

Pepper was attacked less seriously than in former years by *Elasmognathus greeni*. Rice was infested with cutworms, *Cirphis* (*Sideridis*) *unipuncta*, leaf-eating caterpillars, a Cecidomyid midge, *Schoenobius incertellus* (*bipunctifer*), *Chilo* sp., and mole-crickets.

Tobacco pests included *Setomorpha margalaestriata*, *Prodenia* sp., *Phthorimaea* (*Gnorimoschema*) *heliopa* and *Heliothis* sp. Owing to the constant precautions employed, *Lasioderma* [*serricorne*] did comparatively little damage, though tobacco from the 1916, 1917 and 1918 crops were in storage.

Tea suffered less than in 1917 from *Helopeltis*. *H. antonii* was noted on *Melia azedarach*. The orange mite, *Brevipalpus* [*obovatus* ?] caused much loss on some estates. The leaf-rollers, *Homona* (*Capua*) *coffearia* and *Gracilaria theivora*, decreased and in some cases were entirely absent. Young tea-plants from nurseries were found on two occasions to be infested with a species of *Xyleborus*.

LEEFMANS (S.). **De tweekleurige Klapperbladkever** (*Brontispa* (*froggatti*, **Sharp ?**)). [The Two-coloured Coconut Leaf-Beetle.]—*Meded. Laboratorium voor Plantenziekten, Buitenzorg*, no. 35, 1919, pp. 1–14, 3 plates.

A note attached to this paper states that the Hispid beetle here discussed, has now been identified as *Plesispa reichei*, Chap., of which there does not appear to be any previous record from the Dutch East Indies. On the West Coast of Sumatra very young coconut plants, either in the nurseries or newly planted out, are chiefly attacked, but

plants up to 3 or 4 years old may also suffer; important damage to older palms has not been noticed. *P. reichei* develops between the folds of the opening fronds, where the larvae and adults feed upon the leaf-tissue, neglecting the veins running to the top of the leaf and eating the cross veins, so that a striped effect results which is very different from the window-like appearance of injury due to *Brachartona catoxantha*, which leaves the cross veins. The leaves become reddish brown, black spots appear and severe infestation results in the leaf turning entirely brown; in many cases the young shoots decay and the plant dies. The damage done by the larvae and adults of *P. reichei* appears to be increased by a fungus, *Pestalozzia palmarum*, which seems to penetrate the leaf-tissue at the injured spot.

Descriptions are given of the egg, larva, pupa and adult of this beetle. The egg-stage lasts 7–10 days. The young larva measures about 2 mm. in length and is white; it begins to feed immediately and reaches its maximum growth in 31–38 days. When full-grown, it measures 8–9 mm. in length, is dirty white or yellow in colour, very flat, slow-moving, and nearly always hides between the folds of the fronds. The pupa is of a butter-yellow colour. The pupal stage lasts 7–9 days. The adult beetles are long-lived, a period of 6–8 months being observed in the laboratory. The largest number of eggs laid by one female was 93.

Experiments with insecticides showed that tobacco-soap solution or a plain 3 per cent. soap solution were not effective against the eggs, though fairly so against the adults and larvae. These were, however, best dealt with by using a 2 per cent. solution of lead arsenate. As a preventive measure it is well to spray young infested plants in the nursery before planting them out.

LEEFMANS (S.). **De gestreepte Dikkoprups van den Klapper** (*Hidari irava*, **Moore**). [The Striped Skipper Caterpillar of the Coconut.] —*Meded. Laboratorium voor Plantenziekten, Buitenzorg*, no. 35, 1919, pp. 15–31, 4 plates.

The Hesperid butterfly, *Hidari irava*, Moore, has been several times recorded on sago and coconut palms in the Dutch East Indies, but its life-history and parasites have not been studied hitherto. The author has found it on coconut and *Livistona* sp. In the laboratory the caterpillars also fed on the leaves of sago and *Arenga* palms. When given the choice between coconut, *Arenga* and sago they fed to about the same degree on the two first-named and almost neglected sago.

The egg, caterpillar, pupa and adult butterfly are described. The egg-stage lasts 8–9 days. On the coast of Sumatra the entire life-cycle requires 50–57 days, so that 6 or 7 generations may occur in a year. Two other Hesperids, *Erionota thrax*, L., and *Gangara thyrsis*, F., may be mistaken for *H. irava*, but their caterpillars are very different, being covered—even in the active period—with a thick, white, waxy coating. *H. irava* is crepuscular in habit and seldom flies by day. It is but little attracted by light. The caterpillars were found to be parasitised by a Tachinid, a Braconid and by an Ichneumonid (Ophionid). The pupae are parasitised by a Chalcid. An egg-parasite was also observed. These parasites have been submitted

for identification. The two first-named are the only ones of economic importance. Figures and details of these parasites are given.

Hand-picking and spraying are the measures advised; the parasites should be protected and allowed to escape. Solutions of 1 per thousand Paris green or 5 per cent. lead arsenate proved suitable and did no injury to young coconut plants.

PIERS (H.). **The Orthoptera (Cockroaches, Locusts, Grasshoppers and Crickets) of Nova Scotia; with Descriptions of the Species and Notes on their Occurrence and Habits.**—*Proc. & Trans. Nova Scot. Inst. Sci., Halifax*, xiv, no. 3, 1916–1917, pp. 201–354, 4 plates.

Very little is known of the Orthopterous fauna of Nova Scotia, where, as elsewhere, considerable damage is caused to crops by the various species, especially during a succession of dry seasons. An outline of the life-history of Orthoptera in general is given. The chief natural enemies are a mite, *Trombidium locustarum*, a worm, *Gordius* sp., and a fungus, *Empusa grylli*. The usual means of control are advocated.

A large number of species are described, with keys to assist in their identification and notes on their distribution, including:—The cockroaches, *Phyllodromia* (*Blattella*) *germanica*, L. (croton bug) and *Blatta orientalis*, L.; *Chorthippus curtipennis*, Harris (short-winged brown locust); *Camnula pellucida*, Scudder (clear-winged locust); *Dissosteira carolina*, L. (black-winged locust); *Melanoplus atlantis*, Riley (lesser migratory locust) and *M. femur-rubrum*, De G. (red-legged locust). For the latter the following remedial measures are advocated: early spring ploughing to a depth of at least 6 inches and the use of a poison-bait consisting of 20 lb. of bran mixed with 1 lb. of white arsenic or Paris green and added to a mixture of 2 qts. molasses, the juice and finely chopped peel and pulp of 3 oranges or lemons and 3½ gals. of water. This is sufficient for 5 acres. *M. bivittatus*, Say (yellow-striped locust) is attacked by fungi and many parasites including *Trombidium locustarum*, Riley. *Scudderia pistillata*, Brun., is found chiefly on speckled alders (*Alnus incana*), on which it feeds, the eggs being laid on the outer surface of slender twigs or inserted in the edges of leaves.

Crickets include *Nemobius fasciatus*, De G. (striped ground cricket), which does considerable damage owing to its very large numbers, and *Gryllus pennsylvanicus*, Burm. (Pennsylvanian field cricket).

HARDENBERG (C. B.). **South African Bagworms: their Transformations Life-history and Economic Importance. Part II.**—*Annals Natal Museum, London*, iv, no. 1, May 1919, pp. 143–227, 25 figs., 1 plate. [Received 2nd July 1919.]

This is a continuation of a previous paper [see this *Review*, Ser. A, v, p. 378]. Among the species described are *Acanthopsyche tristis*, Janse (thatched bagworm), which has been found in abundance on asparagus and occasionally also on the lower branches of wattle, though no serious damage is recorded. *A. alba*, Janse, feeds on wattle and has occasionally been found on *Cupressus macrocarpa*, privet (*Ligustrum vulgare*) and *Stigmaphyllon ciliatum*. It probably

has two generations a year. *Clania moddermanni*, Heyl., feeds on a variety of fruit and other trees. Each female lays 2,000–4,000 eggs or more, which hatch in about 54 days. The caterpillars feed until May or June, pupation taking place in June and July and lasting probably 2 months. The ravages of this species, which might become very serious, especially in the case of fruit trees, are kept in check by numerous Tachinid and other parasites. Other species are *Manatha aethiops*, Hmp., found on silver wattle (*Acacia dealbata*); *M. subhyalina*, Janse, on *Brachylaena discolor*; *Semimanatha fumosa*, Janse, found on oak (*Quercus pedunculata*) and very heavily parasitised by a small Hymenopteron and a fungus disease; *Monda delicatissima*, Wlk., on *Desmodium incanum*; *M. major*, Heyl., on *Helichrysum parviflorum*; *M. rogenhofferi*, Heyl. (turret bagworm); and *M. heylaertsi*, Junod.

Rokusaburo Kudo. **Contributions to the Study of Parasitic Protozoa. I. On the Structure and Life-history of *Nosema bombycis*, Nägeli.** —*Bull. Imperial Sericultural Expt. Sta. Japan, Tokyo*, i, no. 1, May 1916, pp. 31–51, 2 plates. [Received 9th July 1919.]

The contents of this technical paper are indicated by its title.

Smith (R. C.). **Ear Worm Injuries to Corn and Resulting Losses.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 229–233, 1 plate.

The various types of injury to maize caused by *Heliothis* (*Chloridea*) *obsoleta*, F., are briefly discussed. The first generation of moths usually oviposits in the unfolding leaves in the heart of young plants, in which the larvae, on hatching, eat large, irregular holes. This injury apparently does not necessarily interfere with the production of ears. The larvae may also enter the stalk, but usually next attack the tassels, causing considerable damage to the staminate flowers in the course of a few days. The most important loss is due however to the attack on the ears. As is well known, the moths frequently oviposit on the fresh silk, on which the larvae feed after devouring the empty egg-shells. The larvae may crawl along the silk to the tip of the ear or remain exposed on the silk for several instars, but the most common form of injury involves the severing of the strands below the ends of the husks. When this occurs prior to fertilisation, it results in the absence of kernels on that part of the ear. When the larvae enter the ear, it is usually through the centre of the silk mass. The loss due to the destruction of the kernels themselves is yet another source of loss and has been estimated in various places from a fraction of 1 per cent. to 25 per cent., although in the Southern States as much as 100 per cent. has been recorded.

The damaged ears may be used as food for stock unless the attacks of ear-worms are followed by the appearance of mould, which frequently causes the death of stock, especially horses. The larvae may also continue feeding on the kernels after they harden, in which case only the germ is eaten out.

The damage caused to maize by *H. obsoleta* is aggravated by the fact that the holes made in the husks afford easy access to many other insect pests of maize, especially grain weevils.

HARTZELL (A.). **Notes on the Life History of the Pine Tube Moth** (*Eulia pinatubana*, **Kearfott**).—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 233–237.

Eulia pinatubana, Kearf. (pine tube moth) up to 1905 was confused with the European species, *E. politana*, Haw.; it probably occurs throughout the white pine district of southern Canada and the eastern United States, but its exact distribution is not known.

The white pine (*Pinus strobus*) is the only food-plant recorded. The moths have been taken on this tree in April, June and July. They are crepuscular in their habits and are very sluggish during the day, only flying when disturbed. The larvae are very active and when disturbed, if unable to return to their tubes built of leaves drawn together with silk, they let themselves down by means of a thread. The original tube, each containing one larva, is constructed from five leaves, but, as the larva grows, more are drawn into it for food. The first larvae were noticed in the field on the 20th July; pupation occurs in October and hibernation usually takes place in this stage, although in one case a caterpillar was found in a tube in December. There are probably two generations a year, but this has not yet been proved.

The natural enemies of *E. pinatubana* include the following parasites: *Eurytoma* sp., *Elachistus* sp., *Epiurus indagator*, Walsh, *Eclytus pleuralis*, Prov., and *Itoplectis conquisitor*, Say, reared from the pupae, *Hemiteles* sp., reared from the larvae, and *Epiurus alborictus*, Cress., and *Phytodietus pleuralis*, Cress., reared from both of these stages.

VICKERY (R. A.) & WILSON (T. S.). **Observations on wingless May Beetles.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 238–247, 2 plates.

The ravages caused by *Lachnosterna farcta* in Texas in 1918 were so great that gardens had to be replanted several times. The food-plants of this May beetle are numerous, including a variety of crops and garden plants. In the field, cotton is preferred and has been destroyed in areas of from 5 to 20 acres. Beans seem to be the favourite garden crop. The beetles were observed from the latter part of March until about the middle of July; during this time plants are completely defoliated and the younger ones killed. During the day the beetles hide in the ground, emerging after dark to attack almost any plant in their vicinity; their ravages on old plants are limited to the lower leaves, as they are unable to climb to any height. In the ground they may burrow from 4 to 6 inches, usually near the base of the plant. The remedial measures that were tried are described. The most successful for garden purposes was the erection of barriers made of boards surrounding patches of plants. At intervals along the side of these, vessels with smooth walls should be buried level with the soil surface to act as traps. By this method 102 beetles were caught inside a barrier round a plot 20 feet square and 953 outside in about 53 days. The beetles may be used as food for poultry. Bran mash is suggested for field control.

L. cribrosa, which has very similar habits to, but a much wider distribution than *L. farcta*, was reported in April 1918, and occurred in very large numbers over a limited area of about 70 acres, some

40 acres of cotton being destroyed, involving a loss of about £400. The food-plants include Russian sunflower, *Amaranthus*, lucerne, sorghum, maize, beans and cotton, the latter being preferred in the field. For outbreaks in the field the following bran mash proved to be the most successful: 20 lb. wheat bran, 1 lb. Paris green, 1 qt. of syrup and the juice of 3 lemons or one teaspoonful of anise oil. For large plants a spray of 2 oz. lead arsenate to 3 U.S. gals. of water is recommended, and would protect the crop at the same time from Lepidopterous pests such as *Loxostege similalis*, *Feltia* spp. and *Prodenia* spp.

GOODWIN (W. H.). **Japanese Flower Beetle.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 247–252.

Owing to the establishment of the Japanese flower beetle [*Adoretus umbrosus tenuimaculatus*] in New Jersey over an area of from 4 to 5 thousand acres of productive sandy loam farms, active steps for its eradication were taken in 1918, the plans for which and the subsequent work are here described. Various experiments were made, during which 1 oz. of sodium cyanide to 15 U.S. gals. of water distributed over 25 square feet of ground gave the best results as a soil fumigant, killing 65 to 80 per cent. of the larvae in 3 days. Trap-lanterns proved a complete failure. Dusting was also tried with from 15 to 24 lb. of lead arsenate to 100 lb. of lime, but the value of the result was difficult to ascertain. In the autumn the soil was treated with 1 oz. of sodium cyanide to 12 U.S. gals. of water, using from 15,000 to 25,000 U.S. gals. to the acre.

The pest has certainly been reduced in numbers as a result of these measures, but for its successful eradication the work will have to be continued in 1919, for which purpose new equipment is being secured.

MCCOLLOCH (J. W.). **Variations in the Length of the Flaxseed Stage of the Hessian Fly.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 252–255.

Investigations to determine the duration of the life-cycle of the Hessian fly [*Mayetiola destructor*] show that all stages are liable to vary in duration and that the maximum fluctuation is exhibited by the flax-seed [pupal] stage. A table is given showing the extremes of the different stages of the life-cycle, those for the pupal stage being a minimum of 7 and maximum of 1,083 days.

A great number of pupae were collected, from which 7,461 adult flies were reared; the time between their collection and emergence varied greatly, the two extremes being 2 and 1,083 days. Further experiments are being made to determine whether the results are similar under field conditions. The pupal stage certainly withstands extreme weather conditions better than any other.

FLUKE (C. L.). **Does Bordeaux Mixture repel the Potato Leaf-hopper?** —*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 256–257.

A short account is given of experiments made with sprays consisting of zinc arsenate and Bordeaux mixture against tip burn of potatoes

associated with leaf-hoppers [*Empoasca mali*]. In all cases Bordeaux mixture gave better results than Black Leaf 40 and seems to act as a decided repellent to leaf-hoppers, though further investigations are required to prove this.

MOSHER (E.). **Notes on Lepidopterous Borers found in Plants, with special Reference to the European Corn Borer.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 258–268, 4 figs.

This paper is intended to aid in the determination of the European Corn Borer [*Pyrausta nubilalis*] and includes keys to, and descriptions of the larvae of the Lepidopterous families likely to be found in searching for it.

ZETEK (J.). **Notes on some Insect Pests of Costa Rica.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, p. 269.

The insect pests of Costa Rica include several species not yet recorded from the United States, and it is urged that all possible precautions should be taken to avoid their importation. Especial attention is directed to *Aleurocanthus woglumi*, Ashby (spring citrus whitefly), which probably occurs all through Central America and Tropical South America and is found in great abundance on various species of *Citrus* in Costa Rica, where it is believed to be an imported pest from the Caribbean Islands. Its food-plants are very numerous and include various species of *Citrus*, mango, star-apple, cashew apple, papaya, chirimoya, mammee, plantain and coffee. *Lepidosaphes beckii*, Newm. (purple scale) and sooty mould are also extremely abundant on leaves and fruit of citrus.

Rhabdocnemis obscura, Boisd. (Hawaiian sugar-cane borer) is found in abundance on banana stumps and cuttings, and might be very easily introduced into the United States among banana leaves used for packing.

A number of Lepidopterous larvae and pupae were found under the bark of logs stacked ready for shipment. The majority of this timber was infested with several species of borers, but as these have not yet been identified, their importation may not necessarily mean the establishment of a pest new to the United States.

STURTEVANT (A. P.). U.S. Bur. Entom. **A Source of Confusion in Diagnosis of the *Nosema apis* in Adult Bees.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, pp. 269–270.

Attention is called to the fact that all material intended for diagnosis of diseases in adult bees should be treated with iodine solution after a preliminary microscopic examination in order to prevent confusion in identification between *Nosema apis* and starch grains found in the intestinal contents of bees.

HAWLEY (I. M.). **A Note on Temperature in Relation to *Sciara coprophila*, Lintner.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, p. 271.

Experiments made to test the relative growth of beans at different temperatures were interfered with by an outbreak of *Sciara coprophila*,

Lintn., and it was discovered that above 76° F. and below 91° F. is the most favourable temperature for the reproduction of this fly. Infestation may take place at 60°–65° F., but at this temperature the increase of the insect is slow.

COCKERELL (T. D. A.). **A new Monophlebine Coccid from Borneo.**—*Jl. Econ. Entom. Concord, N.H.*, xii, no. 3, June 1919, p. 272.

Llaveia haematoptera, sp. n., from Borneo is described and compared with *L. raddoni*, Westw., and *L. sanguinea*, Ckll.

COCKERELL (T. D. A.). **The San José Scale in the Argentine Republic.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, p. 272.

Attention is drawn to the fact that the San José Scale, *Aspidiotus perniciosus*, has now been recorded for the first time from Argentina.

FELT (E. P.). **Army Worm (*Heliophila unipuncta*, Haw.).**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, p. 272.

The army worm, *Cirphis* (*Heliophila*) *unipuncta*, is reported for the first time from New York State, where it is infesting maize in large numbers. The appearance of this moth so far north leads to the belief that it can withstand cold more successfully than has previously been supposed [see this *Review*, Ser. A, iii, p. 683].

FELT (E. P.). ***Anthrenus verbasci*, Linn., a Seventeen-Year Breeding Record.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 3, June 1919, p. 273.

In ears of maize infested with *Anthrenus verbasci*, L., that were placed in tightly closed jars in April 1902, this beetle has apparently been breeding without interruption for 17 years.

PAILLOT (A.). **Contribution à l'Etude des Parasites microbiens des Insectes. Etude de *Bacillus hoplosternus* (Paillot).**—*Ann. Inst. Pasteur, Paris*, xxxiii, no. 6, June 1919, pp. 403–419, 8 figs.

Experiments made to test the pathogenic action of *Bacillus hoplosternus* upon various insects are described. The larvae of *Porthetria* (*Lymantria*) *dispar* show a decided immunity, and the mechanism of this immunity is discussed at length. In the case of *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*) the larvae are very susceptible, and died within 24 hours when inoculated. Larvae of *Vanessa urticae* and of *Arctia* (*Chelonia*) *caja* are equally susceptible, being killed in 20 to 24 hours from the first passage of the bacillus. At the moment of death, the blood is relatively poor in microbes, and it would seem, therefore, that the bacillus is chiefly pathogenic owing to a toxin that it secretes. After the death of the insect, it continues to multiply in the blood. The larvae of *Malacosoma neustria* perish in 15 to 18 hours after inoculation.

The only Coleoptera experimented with were the common cockchafer (*Melolontha melolontha*) and *Rhizotrogus solstitialis*. Neither of these re-acts on the introduction of the bacillus into the general body cavity; inoculated beetles die in 20 to 24 hours after inoculation. It would seem that the bacillus multiplies less actively in beetles than in the bodies of Lepidopterous larvae, but it must be remembered that the mean temperature during the time of experiments upon cockchafers was not very high.

Porthetria dispar is therefore the only species examined that offered any resistance to the multiplication of *B. hoplosternus* in the blood. As a general rule, the larvae of this moth are only slightly susceptible to the inoculation of parasitic microbes, with the exception of Coccobacilli. Few larvae are found to be infected under natural conditions, especially during the first stage of invasion; towards the end of the period of infestation among belated and weakened individuals the bacilli are more common and cases of immunity less frequent.

GAUTIER (Cl.). **Recherches physiologiques et parasitologiques sur les Larves de Lépidoptères nuisibles.**—*C.R. Soc. Biol., Paris*, lxxxii, no. 19, 21st June 1919, pp. 720–721.

The Braconid, *Apanteles glomeratus*, L., is a well-known internal parasite of *Pieris brassicae*, and has also been known to parasitise *P. rapae* and other Pierines. Out of a hundred individuals of *P. rapae*, taken from a cabbage field in which 95 per cent. of the individuals of *P. brassicae* were parasitised by *A. glomeratus*, only two parasites emerged, the others all reaching maturity. The cocoons of *A. glomeratus* obtained from either host were coloured sulphur yellow, indicating that the yellow pigment is furnished by the larvae of the Braconids, for the blood of *P. rapae* is bright green. In the author's opinion it is only by chance that larvae of *P. rapae* are parasitised by *A. glomeratus*, and generally on account of their proximity to *P. brassicae*; further investigations on this point are being made, and also on the possibility of parthenogenesis in *A. glomeratus*. Hyperparasites of *A. glomeratus* include *Pteromalus puparum*, *Hemiteles fulvipes*, *Tetrastichus rapo* and *Dibrachys boucheanus*.

FEYTAUD (J.). **Moyens de Lutte contre l'Eudémis et la Cochylis.** [Remedial Measures against *Polychrosis botrana* and *Clysia ambiguella*.]—*Bull. Soc. Etude. Vulg. Zool. Agric., Bordeaux*, xviii, nos. 3–4, 5 & 6, March–June, pp. 17–23, 33–42 and 49–54, 4 figs.

The various remedial measures against the vine moths, *Polychrosis botrana* and *Clysia ambiguella*, that have previously been noticed in this *Review* are discussed. A chart is given of the life-histories of these moths, and the usual winter treatments, including hot water spraying, scraping or removing the bark, and washes are reviewed. The author considers that a rational winter treatment would include the removal of bark over about one-third of the vineyard and washes over the other two-thirds that had been scraped one or two years previously. Insecticides for the spring and summer include lead arsenate, nicotine and pyrethrum, and general recommendations for the use of these are given. Bordeaux mixture with the addition of nicotine is said to increase the crop by one-third to one-half. Many kinds of

bait-traps are described with some illustrations. The value of these various treatments in vineyards of different characters is discussed and the conclusion is reached that while each has its own value, insecticide sprays are the most generally applicable and on the whole the most important remedial measure against these pests.

MUIR (F.). **Leafhopper Infestation in Plant Cane.**—*Hawaiian Planters' Record, Honolulu,* xx, no. 6, June 1919, pp. 380–381.

Attention is drawn to the danger of using seed-cane from fields, or portions of fields, in which leaf-hoppers [*Perkinsiella saccharicida*] are numerous. It is evident that seed-cane taken from an average plantation field contains a high percentage of hopper eggs, and such cane is immediately bagged and transported to the new field and the cuttings planted in the same row, or in adjacent rows. Thus seed cane from an infested area would all be planted within a few square yards. Some pieces of infested seed-cane were planted in a glass jar in sand, one inch below the surface, and the sand well watered and pressed down. The young shoots were not more than half an inch above the surface when young hoppers appeared on them. Soaking the seed-cane in water for 24 hours does not kill the leaf-hopper eggs, and experiments are now in progress to determine how long the eggs can withstand immersion in water without being killed. A ratoon crop generally comes up free from hoppers after the processes of harvesting and burning, and is only infested by immigrant adults; these facts are considered to account in some degree for the more frequent outbreaks of leaf-hoppers in young plant cane than in a young ratoon crop.

CAFFREY (D. J.) & BARBER (G. W.). U.S. Bur. Entom. **The Grain Bug.**—*U.S. Dept. Agric., Washington, D.C.,* Bull. no. 779, 24th June 1919, 35 pp., 13 figs.

Chlorochroa (*Pentatoma*) *sayi*, Stål (grain bug) during the past few years has become a serious pest of wheat and other small grain crops of the inter-mountain and south-western States. This is largely due to the cultivation of large areas formerly devoted to grazing, thus causing the insect to change its food-plants from native weeds to succulent crops, which, with better facilities for hibernation, has resulted in a marked increase in the pest.

The life-history, distribution and all stages of the bug are described. The adults appear during the first warm days of late April or early May and oviposit within a few days on the underside of the rubbish or other material composing the hibernating quarters. The average length of incubation throughout the season is 9 days. The nymphal period covers an average of about 43 days, during which four moults occur. Tables show the duration of the stages at various seasons. The young nymphs feed and develop on the young shoots of Russian thistle or other early developing plants. Upon reaching maturity, about the last week in June, the adults of the first generation migrate to fields of grain and feed on the tender stems and heads until the grain ripens. It is during this period that most of the economic loss occurs, the liquid contents of the newly-formed heads being extracted, thus preventing formation of the grain or greatly reducing its weight. Wheat, barley and rye are the preferred food-plants among cultivated

crops, but other cereals are also attacked, as well as lucerne, cotton, peas, beans, cabbage, tomato and lettuce, in addition to many native plants. The eggs of the second generation are usually laid on the under-side of rubbish in the field or on Russian thistle and occasionally on different parts of the cultivated crop. The nymphs from these eggs have not been observed to feed upon cultivated crops, but live upon weeds until reaching the third or fourth instar. The second generation is completed about the same time that the majority of grain crops are harvested, during early August. The surviving adults and large nymphs of the first two generations then migrate to fields of late grain, milo maize, Sudan grass, self-sown wheat, etc., or any native food-plant in the vicinity. Individuals of the third generation feed upon late grain crops or on native food-plants and reach maturity about mid-September. Occasionally a partial fourth generation may develop, though most of the nymphs do not reach maturity. In October or November all adults seek hibernation quarters; many nymphs also enter hibernation but do not survive the winter. The generations overlap considerably and all stages of the insect are found from the middle of May until the hibernation period. There is sometimes a high percentage of mortality during hibernation; the adults apparently lack the power of burrowing beneath the surface of the soil and this exposes them to extreme cold and to their natural enemies.

Parasites of *C. sayi* include the egg-parasite, *Telenomus ashmeadi*, Morrill, which is widely distributed through the area infested by its host, and constitutes one of its most effective natural checks. The short life-cycle of this species (about 20 days in the height of summer) enables it to complete several generations each year and greatly increases its value as a parasite. About 60 per cent. of eggs collected in badly infested fields were found parasitised by this species. A Tachinid, *Gymnosoma fuliginosa*, Desv., parasitises the adults and nymphs in their last instar. The fact that the parasitised insect retains its activity and powers of destructiveness up to within a short time before the parasite is due to emerge, detracts somewhat from the value of this fly, though its seasonal history is very similar to that of its host and there are the same number of generations annually. This parasite hibernates in some instances as a larva within the body of its host, and probably also in the pupal stage beneath the surface of the ground. *Ocypterodes euchenor*, Wlk., is a parasite of minor importance, with a life-history and habits very similar to those of *G. fuliginosa.*

Predatory enemies include the Malachiid beetle, *Collops bipunctatus*, Say, which devours the eggs, and adults of *Sinea spinipes*, H.S., and of *Phymata erosa*, Stål, which feed upon nymphs of *C. sayi* in the field. Several species of birds and toads, as well as poultry, assist in checking the numbers of this bug.

The most effective and practical remedial measure is the destruction of the adults in their winter quarters, by ploughing under or burning all rubbish and weeds, particularly Russian thistle, in and about cultivated fields. Trap-crops, such as Russian thistle, might be sprayed with a strong insecticide or chemical while the bugs are on them thus destroying the weed and the insects together. Hand-picking, and hopperdozers might also prove of value under special conditions.

COBB (N. A.). *Tetradonema plicans*, **nov. gen. et spec., representing a new Family, Tetradonematidae, as now found parasitic in Larvae of the Midge-insect, *Sciara coprophila*, Lintner.**—*Jl. Parasitology, Urbana, Ill.*, v, no. 4, June 1919, pp. 176–185, 8 figs.

The Nematode, *Tetradonema plicans*, gen. et sp. n., here described, was found parasitic in the larvae of *Sciara coprophila*, Lint., as many as 6 to 12 parasites occupying the body of the host. The mature females contain thousands of eggs and it is believed that at least one moult takes place after the parasites enter the host.

HUNGERFORD (H. B.). **Biological Notes on *Tetradonema plicans*, Cobb, a Nematode Parasite of *Sciara coprophila*, Lintner.**—*Jl. Parasitology, Urbana, Ill.*, v, no. 4, June 1919, pp. 186–192, 1 plate, 2 figs.

So far *Sciara coprophila*, Lint., is the only known host of *Tetradonema plicans*, Cobb, and any number from 2 to 20 of these parasitic Nematodes may be found in a single host. Both sexes are present, the males slightly predominating. The worms are usually found in the larvae, causing their death and disintegration, but if owing to slight or late infestation the larvae should pupate, the fly may emerge, but the reproductive organs are replaced by numerous parasites. These parasites may be distributed by means of migration of infested larvae or through infested flies or the eggs exposed after the disintegration of the dead larva may be eaten by other larvae or carried away by the air or water.

The life-cycle from egg to maturity requires about 3 weeks and takes place entirely in the body of the host. The eggs, of which each female contains thousands, hatch within 24 hours if from young females; from older ones they may hatch in a few minutes. Normally these eggs are not expelled until the death of the female.

KNIGHT (H. H.). **Notes on Species of Miridae inhabiting Ash Trees (*Fraxinus*) with the Description of a new Species (Hemip.).**—*Bull. Brooklyn Entom. Soc., Brooklyn, N.Y.*, xii, no. 4, October 1917, pp. 80–82. [Received 21st July 1919.]

These notes have been collected during three seasons' work on the Capsid bugs occurring in New York. All the species dealt with are confined to ash trees, so far as can be determined. *Tropidosteptes cardinalis*, Uhler, was found breeding only on white ash (*Fraxinus americana*), chiefly on the tender and succulent growth. The adults soon leave the place where they were reared and scatter to more favourable growth for oviposition. *Neoborus canadensis*, Van Duzee, was taken on *F. americana* in company with *T. cardinalis* and *N. tricolor*, the life-cycle corresponding very closely with that of *T. cardinalis*. *N. geminus*, Say, may prove to be only a variety of *N. amoenus* with which it occurs on *F. americana*, but is found only during June and early July. *N. amoenus*, Reut., is most abundant on *F. americana* and *F. pennsylvanica* and occurs rarely on *F. nigra*. There are two generations, the first adults maturing about 20th June and the insects continuing on the trees until frost occurs, or about the middle of September. *N. palmeri*, Reut., has been regarded as a variety of *N. amoenus* but is undoubtedly a good species. The author has found it only on black ash (*F. nigra*).

X. pubescens, sp. n., is described, being found only on very young plants of white ash in shady and damp places. *Xenoborus pettiti*, Reut., breeds on *F. americana* in company with *T. cardinalis* and *X. canadensis*. *X. neglectus*, sp. n., is described; this species has not been found abundantly, but probably occurs in numbers on black ash in June. *X. plagifer*, Reut., breeds only on black ash growing in dense swampy woods. *X. commissuralis*, Reut., was found abundantly on *F. nigra* in company with *X. plagifer*.

GIRAULT (A. A.). **Three New Chalcid Flies from North America.**—*Bull. Brooklyn Entom. Soc., Brooklyn, N.Y.*, xii, no. 4, October 1917, pp. 85-86. [Received 21st July 1919.]

The species dealt with include *Elachistus sanninoideae*, sp. n., reared from the pupae of *Aegeria* (*Sanninoidea*) *exitiosa* in Arkansas; *Secodes multilineatus*, sp. n.; and *Ootetrastichus gibboni*, sp. n., taken in association with *Languria mozardi* in Arizona.

GIRAULT (A. A.). **New Chalcid Flies, with Notes.**—*Bull. Brooklyn Entom. Soc., Brooklyn, N.Y.*, xii, no. 4, October 1917, pp. 86–89.

Among the species described are:—*Eurydinota lividicorpus*, sp. n., reared from *Coleophora malivorella* in California; *Telenomus fuscicornis*, Ashm., from the eggs of a moth which feeds upon *Crotolana retusa* in St. Vincent, and *Eurytoma pissodis*, sp. n., taken from the pupal chambers of *Pissodes strobi* in September, in Minnesota.

GAHAN (A. B.). U.S. Bur. Entom. **Some Chalcid-wasps reared from Cecidomyiid Galls.**—*Ann. Entom. Soc. America, Columbus, Ohio*, xii, no. 2, June 1919, pp. 159–170.

The new Chalcids reared from galls of *Asphondylia websteri*, Felt, here described, include *Eurytoma medicaginis*; *Callimome asphondyliae*, which may be a secondary parasite; *Syntomaspis medicaginis*; *Pseudocatolaccus americanus*, which is a true parasite; *Tetrastichus sobrius*, which may be a primary or secondary parasite and may also have been parasitic on *Bruchophagus funebris*; and *Galeopsomopsis transcarinatus*, which may be a primary or secondary parasite.

Syntomaspis umbilicata was reared from a Cecidomyiid on *Suaeda* sp., and the Eulophid, *Paragaleopsomyia gallicola*, from Cecidomyid stem-galls on *Pluchea borealis*.

Specimens of *Bruchophagus funebris*, How., were reared from galls of *Asphondylia websteri*, but may have developed in the lucerne seeds present. The Pteromalid, *Trimeromicrus maculatus*, Gahan, was reared from galls of *A. websteri* in conjunction with *B. funebris*, of which it is a true parasite; this, as well as the Eulophid, *Tetrastichus bruchophagi*, Gahan, reared under similar conditions, may prove to be secondary parasites of *A. websteri*.

MUIR (F.). **The Progress of *Scolia manilae*, Ashm., in Hawaii.**—*Ann. Entom. Soc. America, Columbus, Ohio*, xii, no. 2, June 1919, p. 171.

Anomala orientalis, at one time a very serious pest in Hawaii, where as many as 3,500 grubs could be collected from $\frac{1}{20}$ of an acre in 1917,

is being so successfully controlled by the Hymenopterous parasite, *Scolia manilae*, which has been introduced into Hawaii [see this *Review*, Ser. A, v, p. 426], that now over a much larger area careful searching only revealed 4 grubs.

The parasite seems firmly established and promises to be the eventual cause of extinction of this pest.

Another beetle, *Adoretus tenuimaculatus*, is also attacked by it.

RAMAKRISHNA AYYAR (T. V.). **Some South Indian Coccids of Economic Importance (a).**—*Jl. Bombay Nat. Hist. Soc., Bombay*, xxvi, no. 2, 20th May 1919, pp. 621-628, 4 plates.

This list of Coccids includes the following: *Chionaspis vitis*, Green, on *Vitis lanceolaria*, *Elaeagnus latifolia* and *Loranthus*; *Diaspis echinocacti*, Bch. (prickly-pear scale); *Hemichionaspis aspidistrae*, Sign., on pepper, Ceara rubber [*Manihot glaziovii*], *Citrus*, jak, *Ficus* and coconut, and also causing serious damage to areca palms; *H. theae*, Mask., on tea in Assam; *Aspidiotus destructor*, Sign., on coconut, pepper, Para rubber [*Hevea brasiliensis*] and *Loranthus*, etc.; *A. rapax*, Comst. (*camelliae*, Sign.), on elm, *Grevillea*, *Cinchona* and *Michelia*, and also causing serious damage to tea; *Chrysomphalus aurantii*, Mask., on rose, jasmine, agave, pomelo and orange in Ceylon; *C. aonidum*, L. (*A. ficus*, Ashm.), on citrus, *Ficus* and mango; *Mytilaspis piperis*, Green, on black pepper; *Pulvinaria psidii*, Mask., damaging coffee, tea, mango, *Citrus* and *Morinda*; *P. maxima*, Green, found on Margossa trees and mulberry plants and attacked by the black ant, *Camponotus compressus*, and a Coccinellid; *P. thespesiae*, Green, on *Thespesia populnea*; *Ceroplastes actiniformis*, Green, on coconut, mango, canna, *Ficus*, *Calophyllum* and *Loranthus*; *Ceroplastodes cajani*, Mark, on red gram, *Dolichos lablab*, *Zizyphus jujuba* and *Ocimum sanctum*, a moth, a species of *Eublemma*, being predaceous on it; *Saissetia* (*Lecanium*) *nigra*, Nietn. (black scale) on cotton, *Thespesia populnea*, *Hygrophila spinosa*, sandalwood, garden crotons and *Hibiscus esculentus*, and in some parts of India on coffee, tea, rubber, etc.; *S.* (*L.*) *hemisphaerica*, Targ., on tea, coffee, guava, cinchona etc.; *S.* (*L.*) *oleae*, Bern., on tamarind, *Hygrophila spinosa*, coffee, *Sesbania* and *Thespesia*. *Coccus* (*L.*) *viridis*, Green, on coffee, tea, *Aegle*, *Carissa*, guava, *Citrus* and *Plumeria acutifolia*; *Hemilecanium imbricans*, Green, on *Jatropha multifida*, *Ailanthus excelsa*, cedar and *Ficus* sp.; *Dactylopius confusus indicus*, Green, effectively destroying *Opuntia monacantha*; *Pseudococcus citri*, Risso, on a variety of food-plants, including cacao and coffee; *P. virgatus* on garden plants such as croton, tomato, *Sesbania*, *Hibiscus* and Cambodia cotton; *P. sacchari*, Ckll., infesting the leaf-sheaths of rice and causing a disease called "choorai"; *P. corymbatus*, Green, on jak, *Citrus* and cotton plants; *Phenacoccus insolitus*, Green, on egg-plant and *Sida cordifolia*; *P. iceryoides*, Green, on *Citrus*, mango, *Odina wodier*, *Boswellia*, *Capparis* and mango; *Ripersia sacchari*, Green, on sugar-cane; *Anomalococcus indicus*, Green, a specific pest of *Acacia arabica*, its natural enemies being *Eublemma scitula* and a black ant, *Camponotus compressus*; *Cerococcus hibisci*, Green, found on cotton but not a serious pest; *Tachardia lacca*, Kerr, on mango, *Dalbergia lanceolaria*, rain tree and *Shorea*, and also cultivated on *Acacia*, *Ficus*, *Zizyphus* and red gram,

&c.; *Monophlebus tamarindus*, Green, on garden crotons; *Walkeriana cinerea*, Green, on *Lawsonia alba*, sandalwood and *Thespesia populnea*; *Icerya aegyptiaca*, Dougl., on the bread-fruit tree (*Artocarpus incisa*), jak and *Ficus*.

Beeson (C. F. C.). **The Food Plants of Indian Forest Insects. Part iii**—*Indian Forester, Allahabad*, xlv, no. 6, June 1919, pp. 312–323.

This paper is a continuation of lists previously noticed [see this *Review*, Ser. A, vii, p. 291]. Among the Coleopterous pests dealt with are the Chrysomelids, *Aspidomorpha sanctaecrucis*, F., on *Tectona grandis*; *Clitea picta*, Baly, on *Aegle marmelos*; *Colasposoma semicostatum*, Jac., on *Citrus aurantium* and *Vitex negundo*; *Crioceris impressa*, F., on *Ficus elastica* and *Holarrhena antidysenterica*; *C. quadripustulata*, F., on *Terminalia tomentosa* and *Trewia nudiflora*; *Diapromorpha turcica*, F., on *Acacia catechu*; *Estigmena chinensis*, Hope, on *Dendrocalamus strictus* and *Cephalostachyum pergracile*; *Melasoma populi*, L., on *Salix elegans*, *S. babylonica* and *Populus ciliata*; *Mimastra cyanea*, Hope, on *Grewia asiatica*, *Pyrus communis* and *P. pashia*; *Platypria andrewesi*, Weise, on *Zizyphus jujuba*; *P. hystrix*, Jac., on *Erythrina indica* and *Sesbania grandiflora*; *Podontia quatuordecimpunctata*, L., on *Spondias mangifera* and *Ficus elastica*; *Sagra longicollis*, Lac., and *S. jansoni*, Baly, on *Tectona grandis*.

The Cistelids, *Cistelomorpha andrewesi*, Fairm., on *Pinus excelsa*, and *C. annuligera*, Fairm., on *Cedrus deodara* and *Pinus excelsa*.

The Curculionids, *Alcides frenatus*, Fst., on *Mangifera indica*; *A. ludificator*, Fst., on *Tectona grandis*; *A. porrectirostris*, Mshl., on *Juglans regia*; *Apoderus blandus*, Fst., and *A. sissu*, Mshl., on *Dalbergia sissoo*; *A. tranquebaricus*, F., on *Terminalia catappa*; *Astycus aurovittatus*, Hell., on *Tectona grandis*; *A. chrysochlorus*, Wied., on *Hevea brasiliensis* and *Pithecolobium saman*; *A. lateralis*, F., on *Camellia thea* and *Tectona grandis*; *Atmetonychus peregrinus*, Oliv., on *Prunus communis*, *P. persica*, *Mangifera indica* and *Zizyphus jujuba*; *Brachyxystus subsignatus*, Fst., on *Abies webbiana*, *Cedrus deodara* and *Picea morinda*; *Cercidocerus bimaculatus*, Boh., on *Dalbergia latifolia*; *Conarthrus jansoni*, Woll., on *Shorea robusta*; *Cryptorrhynchus brandisi*, Steb., on *Pinus khasya*, *P. longifolia* and *Tectona grandis*; *Cyrtotrachelus longipes*, F., on *Dendrocalamus strictus* and *Melocanna bambusoides*; *Dereodus pollinosus*, Redt., on *Pyrus malus*, *Shorea robusta* and *Zizyphus jujuba*; *Emperorrhinus defoliator*, Mshl., on *Alnus nitida*, *Prunus armeniaca*, *Pyrus communis* and *P. malus*; *Eugnathus curvus*, Fst., on *Butea frondosa*; *Himatium asperum*, Mshl., on *Shorea robusta*; *Hypomeces squamosus*, F., on *Bombax malabaricum*, *Hevea brasiliensis* and *Hibiscus rosa-sinensis*; *Myllocerus discolor*, Boh., on *Aegle marmelos*, *Eriobotrya japonica*, *Mangifera indica*, *Psidium guyava* and *Zizyphus jujuba*; *M. sabulosus*, Mshl., on *Casuarina equisetifolia*, *Mangifera indica*, *Psidium guyava* and *Zizyphus jujuba*; *M. viridanus*, F., on *Psidium guyava* and *Tectona grandis*; *Phaenomerus brevirostris*, Mshl., on *Shorea robusta*; *P. sundewalli*, Boh., on *Butea frondosa*, *Dalbergia sissoo*, *Heritiera fomes* and *S. robusta*; *Rhyncholus himalayensis*, Steb., on *Cedrus*

deodara, Picea morinda and *Pinus excelsa*; *Rhynchophorus ferrugineus*, Oliv., on *Cocos nucifera, Phoenix dactylifera* and *P. sylvestris*; *Sipalus hypocrita*, Boh., on *Aesculus punduana, Bombax malabaricum, Dalbergia cultrata, Pinus khasya* and *Pterocarpus dalbergioides*; *Trigonocolus brachmanae*, Fst., on *Butea frondosa, Ougeinia dalbergioides* and *Pterocarpus dalbergioides*.

SMULYAN (M. T.). U.S. Bur. Entom. **Some Observations on the Webbing Clothes Moth** (*Tineola bisselliella*, **Hum.**).—*Psyche, Boston, Mass*, xxvi, no. 3, June 1919, pp. 71–73.

Observations made on *Tineola bisselliella*, Hum., kept in glass jars lined with felt, are recorded. This species of clothes moth seems to be more common than *Tinea pellionella* (case-making clothes moth) in the northern States. A marked variation was observed in the degree of activity and sensitiveness among the larvae but whether this is a question of individuality or of sex has not yet been determined.

TRAVER (J. R.). **Ecological Relations of the Lepidopterous Genus** *Depressaria* (**Oecophoridae**).—*Psyche, Boston, Mass.*, xxvi, no. 3, June 1919, pp. 73–80.

The species of *Depressaria* vary greatly in their life-habits. Their ecological relations are discussed and a table showing their world-wide distribution is given. Of the 249 known species of this genus, the only ones that are of economic importance in the United States are: *D. groteella* on hazel, *D. robiniella* on locust trees, and *D. heracleana* on parsnip.

WEISS (H. B.). **The More Important Nursery Insects in New Jersey.**—*New Jersey Dept. Agric., Bur. Statistics & Inspec., Trenton, N.J.*, Circ. no. 26, April 1919, 47 pp., 44 figs. [Received 22nd July 1919.]

This circular has been compiled for the use of nurserymen. As 90 per cent. of the nursery area in New Jersey is devoted to ornamental plants, only those insects injurious to such plants are dealt with. Descriptions are given of the general appearance, life-history, food-plants and remedial measures for each species, much of the information having been previously recorded [see this *Review*, Ser. A, iii, p. 514; vi, p. 204, etc.].

JARDINE (N. K.). **Tea Tortrix. Preliminary Report on the Spraying Experiments.**—*Trop. Agriculturist, Peradeniya*, lii, no. 6, June 1919, pp. 336–338.

An investigation has been carried on for five months with the object of finding a practicable wash that will kill the tea tortrix [*Homona coffearia*] and render the tea bushes distasteful to this moth. It is proposed to use such a wash on the rows of old tea bushes to be left as wind-belts or flight-breaks on the ridges exposed to the south-west monsoon [see this *Review*, Ser. A, vii, p. 112].

The experiments were carried out on old and large bushes and under conditions of the greatest difficulties as regards water transport, etc. Two washes gave good results; the sprayed bushes were free from insects without injury to them or to the flavour of the tea, and yielded a larger crop than the untreated ones. No. 1 wash was composed of 1 oz. lead chromate per 4 gals. of water; No. 2 was the same with the addition of 1 pint of resin compound (2 lb. resin and 1 lb. sodium carbonate in 3 gals. of water). The cost of spraying was high under the conditions obtaining; for practical purposes the estimated cost for spraying bushes 6 or 8 months from pruning is 6*s*. 8*d*. per acre for No. 1 wash and 8*s*. 8*d*. per acre for No. 2, inclusive of materials, labour and water transport; this cost could probably be reduced considerably in practice by ordering larger quantities of the material at a time. No. 2 wash was considered to improve the flavour of the tea; neither wash is affected by rain when once it has dried on the leaves. Difficulties of water transport may be materially lessened by sinking small reservoir in the area to be treated.

Arce (B.). **Instructions for the Control of Rice Worms (*Prodenia litura*, Fabr., and *Spodoptera mauritia*, Boisd.).**—*Trop. Agriculturist, Peradeniya*, lii, no. 6, June 1919, pp. 347–348.

In the Philippines, the cutworms, *Prodenia litura*, F., and *Spodoptera mauritia*, Boisd., damage rice almost every year when the seedlings in the seed-bed are vigorously growing and about to be transplanted, and injury is also done to cabbages, tomatoes, tobacco and other plants. The stages in the life-cycle of these moths are described and tabulated, that of *P. litura* occupying 33–50 days and that of *S. mauritia* 31–66 days. Rice plants should be sprayed with 1 lb. lead arsenate to 10 gals. water, preferably in the evening. Sweeping with a net is also practical and successful. When there is plenty of water, after the dykes are repaired, the seed-beds may be submerged; the caterpillars then float on the surface and can be collected or skimmed off.

Anderson (T. J.). **The Coffee Bug, *Antestia lineaticollis*, Stål.**—*Brit. East Africa, Dept. Agric., Nairobi, Div. Entom.*, Bull. no. 1 [n.d.], 53 pp., 7 figs. [Received 23rd July 1919.]

The species of *Antestia* found in Africa include *A. falsa*, Sch., *A. transvaalia*, Sch., *A. usambarica*, Sch. and *A. lineaticollis*, Stål, the latter being the only one so far recorded from the East African Protectorate, where it is present in great numbers as a coffee pest. The bugs are most numerous from January and February to July and August. The life-cycle, of which all stages including egg, 5 nymphal instars and adult are described, varies greatly in duration according to the seasons. Tables are given showing this variation. The adults, although winged, are seldom seen to fly, and the possibility of flight from one bush to another has not yet been proved. They feed on the green berries, buds, green twigs and even leaves of the coffee plant, but a marked preference is shown for the berries, which may shrivel and drop off. If the buds are punctured, development is retarded, with the result that fewer flowers develop with a corresponding reduction in the amount of berries produced. The average length of life of the adult female is 131 days, that of the male 106 days.

The eggs, which are usually deposited in batches of twelve, may be found on the upper surface of the leaves, the berries and their pedicles, the stem, dry leaves or stones beneath the bushes, but the favourite place is the under-surface of the leaves; they are fixed at the point of attachment and to each other by a gummy secretion. Oviposition generally takes place at night, each female laying on average 126 eggs, though the numbers vary greatly. The duration of the egg-stage varies from 8 to 15 days, being shortest from January to April.

The average duration of the first instar of eggs hatched in June, July and August is from 14 to 15 days, and for those hatched from December to January from 9 to 13 days. During this period the insects seldom wander far from the egg-shells, but after the first moult they become very active and feed voraciously. The average duration of the second instar in July to September is from 32 to 67 and in October to February from 13 to 20 days. The next two instars have approximately the same duration, averaging about from 22 to 50 days for the earlier broods, the later ones being comparatively shorter, whereas the 5th instar has an average duration of 22 to 32 days. After the 5th moult the insect acquires wings.

There are about five species of Chalcids parasitic on *A. lineaticollis* of which two, though not yet identified, are here described and referred to as "A" and "B." Experiments were made to determine the length of life of these parasites, records of which are given in a table; that of "A" averages 6 days for males and 5 days for females, and of "B" 3 days for males and 4 for females. These parasites also reproduce parthenogenetically, but in these cases all the offspring are males. Under field conditions the numbers of females greatly exceeds that of males so that parthenogenesis is comparatively rare. Both "A" and "B" are found together in the field, but the proportion of one to the other seems to depend on climatic conditions. Abundance of the host-eggs and a high temperature seem to be more advantageous to "A" than to "B," and further investigations are being made to determine this point. There is every reason to believe that these parasites may prove a successful means of controlling the insect as the duration of their life-cycle is about ⅓ that of their host.

Owing to the affinity of this bug for sunshine, shade-trees may prove of value as a means of control. The chief remedial measures advocated are cultural methods, including immediate removal and burning of all prunings and the stimulation of growth by manuring and irrigation; hand-picking is also recommended. Stomach poisons have been tried, but without success, and experiments are now being made to determine the efficiency of contact-sprays.

A comparison is drawn between some small differences in the habits, etc., of this bug in British East Africa and Uganda.

WASHBURN (F. L.). **Some Useful Birds found in Minnesota: Their Economic Relations to the Agriculturist.**—*Minnesota State Entomologist, St. Paul, Minn.*, Circ. no. 43, 1st May 1917, 47 pp., 3 plates, 25 figs. [Received 26th July 1919.]

This circular is a reprint of information that has already been noticed [see this *Review*, Ser. A, iii, p. 161 and v, p. 465].

ROHWER (S. A.). **Descriptions of four new parasitic Hymenoptera.**—*Canadian Entomologist, London, Ont.*, li, no. 6–7, June–July 1919, pp. 160–162.

The new species of Hymenopterous parasites here described are: *Tetrastichus rugglesi* bred from *Agrilus arcuatus* in Minnesota, and *Trigonura hicoriae, Ecphylus hicoriae* and *Heterospilus blackmanni*, all bred from *Hicoria glabra* in New York.

TREHERNE (R. C.). **Wireworm Control, with special Reference to a Method practised by Japanese Growers.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 6, June 1919, pp. 528–530.

The usual remedial measures against wireworms practised in Europe and America are reviewed, including seed treatments, soil fumigation, soil treatments, soil handling, trapping and baiting. As the onion-growing industry in British Columbia is largely in the hands of the Japanese, it was a matter of interest to observe the methods employed by them. These comprised the use of baits made of rice shorts or rice bran roasted dry in pans or on sheets of tin over a fire. These have a strong odour which is said to be attractive to wireworms. The roasted substance is moistened with a little water and moulded by hand into small compact balls, which are then placed in the ground in holes about ten feet apart between the rows of onions. In about a week or ten days the baits are taken up, broken open, and the wireworms removed by hand and destroyed. The baits can then be re-moulded and re-set. An experiment was tried with these baits on 4 acres of ground on 25th April, the cost being nearly £3. A table shows the records of captures examined on 2nd May, when the onion plants were about 1 in. above the ground. Those on land previously baited yielded an average of from 1·9 to 3·9 wireworms per bait, while on land not previously baited the average was from 20·2 to 22·6 per bait. From the remainder of the plantation 5,755 baits captured 24,869 wireworms; this is not a very high average, but in view of the large acreage and the variability of infestation the results were considered to show that this method has a distinct value in wireworm control. A single bait, used twice on a heavily infested spot, yielded 90 wireworms, so that the statement of Japanese growers, that over 100 individuals may be taken in a single bait, seems quite possible.

HOLLOWAY (T. E.) & LOFTIN (U. C.). **The Sugar-Cane Moth Borer.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 746, 18th April 1919, 74 pp., 9 plates, 12 figs. [Received 26th July 1919.]

This bulletin deals at length with *Diatraea saccharalis crambidoides*, Grote (sugar-cane moth borer), and its economic importance as a pest of sugar-cane. The history and distribution of the various species of *Diatraea* and their native food-plants are given. The various stages of *D. saccharalis crambidoides* are described and its life-history and seasonal occurrence discussed.

Natural control is exercised to some extent by a number of factors. Experiments in Porto Rico indicate that this borer is adversely affected by rainfall [see this *Review*, Ser. A, iv, p. 115 etc.], but in Louisiana this does not seem to be the case; a series of graphs illustrates the absence of relation between rainfall and infestation in that State. Flooding the cane-fields apparently reduces the numbers considerably, but in the following year the borers occur as abundantly as ever. Irrigation seems to have no effect upon infestation. A fungous disease has been observed to infest the larvae, but its occurrence under natural conditions is very rare.

Parasites and predaceous enemies of the borer include a Chalcid, *Trichogramma minutum*, Riley, which is well known as an important factor in control in Louisiana and Texas. A similar parasite, *Ufens niger*, Ashm., was found in Texas in 1912, but has not been observed since. *Microgaster* sp. and another Braconid have been reared from the larvae of other species of *Diatraea*. A Telephorid beetle, *Chauliognathus marginatus*, F., has been recorded as feeding on the larvae, and is occasionally found in considerable numbers in sugar-cane fields in Louisiana. Earwigs and the Argentine ant (*Iridomyrmex humilis*, Mayr) are predators, but cannot be considered of any importance. The natural enemies of *D. saccharalis* in foreign countries are reviewed.

The methods of diposing of cane trash left in the fields after the crop has been gathered are dealt with. These include burning with oil, the efficacy of which, as compared with ploughing under, has been much discussed [see this *Review*, Ser. A, ii, p. 279 & iv, p. 114]. Cutting out the dead hearts of infested plants and burning them in the spring, when the larvae are still within them, is theoretically a sound practice, and where labour is abundant and cheap, has proved successful. This practice should be carried out three times early in the growing season. Arsenical poisons on the cane plants are of no value, probably because the poison does not enter the central whorl where the young larvae are feeding. Experiments with honey and other baits and also with light-traps were tried without success.

Seed should be planted in autumn, if possible, and kept as deeply covered as is practicable. Very deep planting is not advocated, but as the moths can emerge from cane under ½-inch of either clay soil or sand (though larger numbers emerge from sand), a good covering of soil should be maintained and replaced if washed away by rain. Canes for planting in uninfested areas should be obtained free from borers if possible, otherwise they should be soaked for at least an hour in nicotine sulphate or Bordeaux mixture, which prevents the eggs from hatching.

The ploughing in of the stubble and rubbish left in the fields after gathering the crop is described. Experiments over a number of years tend to show that burning is unnecessary, but that the trash should be lightly covered with soil in the autumn and ploughed under in the spring; in this way very valuable fertilising matter is added to the soil and its mechanical condition greatly improved. The authors are of opinion that burning or not burning trash will be found to be a matter for the judgment of the plantation manager, in Louisiana as well as in other countries. The introduction of parasites of the moth borer from Cuba and other tropical countries is recommended [see also this *Review*, Ser. A, vii, p. 279].

DRAKE (C. J.). **On some Tingidae new to the Fauna of Canada (Hemip.).**—*Canadian Entomologist, London, Ont.*, li, no. 6–7, June–July 1919, p. 159.

This list includes *Corythucha salicis*, Osborn & Drake, found on *Salix discolor* and other species of willow, as well as on *Ribes* spp.; *C. elegans*, Drake, on poplar (*Populus balsamifera*) and willow; *C. padi*, Drake, on choke cherry (*Prunus demissa*); *C. parshleyi*, Gibson, on walnut (*Juglans nigra*), butternut (*J. cinerea*), Japanese walnut (*J. sibboldiana*) and Juneberry (*Amelanchier intermedia*), its range extending from Canada to North Carolina; *C. heidemanni*, Drake, on birch; *C. betulae*, Drake, on yellow birch (*Betula lenta*); *C. immaculata*, Osborn & Drake, on balsam root (*Balsamorrhiza sagittata*); and *C. hewitti*, sp. n., on hazelnut (*Corylus americana*).

YOTHERS (W. W.). **The Woolly White Fly in Florida Citrus Groves.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1011, February 1919, 14 pp., 8 figs. [Received 26th July 1919.]

Aleurothrixus howardi, Quaint. (woolly whitefly), recently introduced into Florida citrus groves, while not as injurious as *Dialeurodes citri*, Ashm. (citrus whitefly) or *D. citrifolii*, Morg. (cloudy-winged whitefly), sometimes causes considerable loss to growers. The favourite food-plant is grape-fruit, but tangerine, lemon and kumquat trees are also attacked, as well as sea-grape, common guava, mango, and a species of rubber. There are four generations in a year, adults being most abundant in December and January, the latter part of May, the latter part of July, and October and November. If spraying is found necessary, this should be done about one week after the flies have disappeared, when the eggs have hatched and the young larvae have not developed the thick woolly covering that protects them from sprays. The methods of control of this pest, both by natural and artificial means have previously been noticed [see this *Review*, Ser. A, v, p. 49, etc.].

BACK (E. A.). **Conserving Corn from Weevils in the Gulf Coast States.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1029, February 1919, 35 pp. 21 figs. [Received 26th July 1919.]

The average loss of maize from weevil attack in the southern United States is estimated at not less than 10 per cent.; in many instances it is much greater. The majority of the damage is done by *Calandra oryzae*, L. (rice weevil), and *Sitotroga cerealella*, Oliv. (Angoumois grain-moth); the injury to the kernels is described. *Heliothis* (*Chloridea*) *obsoleta*, F. (corn earworm) greatly assists the weevils by making punctures in the shuck and silk through which the weevils can enter. *Pyroderces rileyi*, Wals. (pink cornworm) feeds on the kernel and cob and also on the husk covering, thus reducing its value as a protection from the weevils. A Bostrychid beetle, *Dinoderus truncatus*, Horn (larger grain borer), also perforates the husk.

The control of weevils is considered a simple matter if given a proper place in farm economy. The greater resistance to weevil attack of maize with a good shuck covering is pointed out and illustrated, and the methods of dealing with different ears according to their shuck protection is fully discussed [see this *Review*, Ser. A, vii, p. 3]. Only those ears with the best shuck protection should be used for seed.

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The fact that a field is generally most heavily infested in the outer rows next to the woods has led to the planting on that side of a few trap-rows of early-sown or more rapidly maturing seed, on which the weevils concentrate. These rows should be gathered and the ears fumigated before the main crop is harvested. The crop should be gathered as soon as possible and no rubbish should be left in the field in which the weevils can breed during the winter. It must be remembered that nothing can be done to kill weevils while the maize is in the field. The methods of dealing with the gathered crop have already been described [*loc. cit.*]. When stored, fumigation with carbon bisulphide should be practised for any infested maize, or as soon as any weevils or moths appear in the bin. If they are numerous, a second fumigation should follow 2 or 3 weeks after the first, and if weevils begin to appear during the warm days of spring the maize should be fumigated a third time. Some farmers have lately begun the practice of shucking all maize before it goes into storage and then fumigating clean and infested seed together. The method and cost of fumigation is discussed and types of fumigating sheds are described and illustrated.

HORTON (J. R.). **Insect Pests of Figs.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1031, March 1919, pp. 28-34. [Received 26th July 1919.]

This paper forms a section of a bulletin by H. P. Gould, entitled "Fig Growing in the South Atlantic and Gulf States." Well-kept fig orchards in these States are not very susceptible to the attacks of insects of serious economic importance. By far the most injurious are three or four species of wood-boring beetles, of which the chief is *Ptychodes vittatus* (three-lined fig-tree borer). This Longicorn appears about March and continues to oviposit throughout the summer, in the bark of the trunk or larger branches, generally in the neighbourhood of a wound or diseased portion of the tree. The females live from three to eight or nine months and deposit from 130 to 260 eggs each.

The young larvae feed along the bark near the surface for two or three weeks and then work into the wood, sometimes going to the heart of the branch or trunk. After mining for two or three months the larvae pupate. A perfectly sound tree is seldom attacked, except when the borers are excessively numerous. The insects thrive in either living or dead wood, but prefer wood that is dying and has lost a portion of its sap. Preventive measures against the borer are better than remedies. The young trees should be pruned to the best shape for withstanding heavy winds. Accidental wounding of the bark should be avoided, and where a branch is broken off the wound should be painted with a mixture of 5 parts of coal-tar and one part of creosote or crude carbolic acid, applied in two or three coats. Trees that have become thoroughly infested should be cut down and burnt, as the insects survive in dead wood. If infestation is only slight and its area limited the eggs may be destroyed with a sharp knife, but all cuts made in removing eggs or larvae should be carefully dressed and treated. Oviposition may be prevented to a considerable extent by ensheathing the trunk and larger branches in wire netting practically throughout the year.

The mealy-bug, *Pseudococcus citri*, Risso, frequently infests the branches and leaves of fig trees, and where the Argentine ant,

Iridomyrmex humilis, occurs and protects it from its enemies, is sometimes very abundant in April, May and June, and may continue until mid-August. Where the Argentine ant is not present, these scales usually disappear during May. *Coccus hesperidum*, L. (soft brown scale) is sometimes found in groups on certain branches of fig-trees and along the lower surface of the leaves near the midrib. This scale has as yet been kept in check by natural agencies. In Smyrna, the larvae of *Ephestia cautella*, Wlk. (fig moth) bore into the figs, but this pest is not found in the United States and in consequence of inspection regulations is unlikely to be introduced. June bugs, bees and wasps, are frequently seen on figs, apparently eating the fruit, but the damage from these insects is comparatively slight.

CAFFREY (D. J.). **The European Corn Borer: A Menace to the Country's Corn Crop.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 1046, April 1919, 28 pp., 17 figs. [Received 26th July 1919.]

An account is given of the life-history and habits of *Pyrausta nubilalis*, Hb. (European corn borer), the injury to maize being described in detail [see this *Review*, Ser. A, vii, p. 224]. Natural enemies in Massachusetts are very few and cannot be relied upon to hold the pest in check. A small percentage of the caterpillars are destroyed by the Tachinids, *Masicera myoidea*, Desv., *Exorista pyste*, Wlk., *E. nigripalpis*, Towns., and *Phorocera erecta*, Coq., which pupate within the tunnels of the borer. The Hymenopterous parasites, *Epiurus* (*Pimpla*) *pterophori*, Ashm., and *Amblyteles brevicinctor*, Say, also destroy a small number, but none of these enemies is sufficiently numerous to be an effective check on the pest.

While the chief danger to maize-growing lies in the introduction of infested plants, which can only be met by stringent quarantine measures, infestation may also spread by flight of the adults and by old plant material harbouring the borers through the winter. The best method of destruction of infested material is by burning [*loc. cit.*], but under certain conditions infested plants may be used as food for stock, either direct from the field or as ensilage. It is also possible to bury infested plants in manure or compost piles, in which case care must be taken that there is sufficient manure to ensure thorough heating and early decomposition of the material. The practice of ploughing under infested material is not recommended, as the rubbish cannot be covered deeply enough to prevent the borers from coming to the surface. Damage by borers can be lessened to some extent by regulating the time of planting. This will naturally vary each year with weather conditions, but as the moths prefer to oviposit on maize in which the tassel has already developed, it is well to plant the maize somewhat late so that the tassel stage may be reached about 1st July, when most of the moths have already oviposited. Arsenical poisons are not successful against *P. nubilalis*.

ILLINGWORTH (J. F.). **Cane Grub Investigation.**—*Queensland Agric. Jl., Brisbane*, xi, no. 6, June 1919, pp. 258–261.

Sugar-cane seems to have suffered much less in the past year from the attacks of grubs [*Lepidiota*]; this was partly due to the continuous cultivation which was rendered possible owing to the dry weather.

Arsenic at the rate of 10 lb. per acre was tried without success, both as a spray and in the form of dust at the time of ploughing. A marked difference was however noticed between the fields where—owing to late planting—cultivation had continued throughout the flight of the beetles and those where these measures had not been taken.

Owing to the attraction that meatworks manure has for the grubs it was mixed with 10 lb. of white arsenic per acre; this considerably reduced the injury, and on plots where 20 lb. of arsenic was used with 5 cwt. of manure per acre the grubs have so far not appeared at all.

AGEE (H. P.) & SWEZEY (O. H.). **Director's Report.**—*Proc. 38th Ann. Meeting Hawaiian Sugar Planters' Assoc., Honolulu, December 2, 3 and 4, 1918*; 1919, pp. 153–216.

The conditions in Hawaii in 1918 with regard to insect pests were more favourable than during the previous years. This was chiefly due to the effectiveness of imported parasites, of which *Scolia manilae* is now well established in the fields and has considerably checked the ravages of the larvae of *Anomala.* Three colonies numbering a total of 19,833 adults of this parasite have been liberated during the year. The species of *Tiphia, Prosena* and *Dexia* liberated in 1916 and 1917 do not show any signs of becoming established, and the same may be said of a large Carabid beetle from Japan and of *Tiphia lucida* from the Philippines. *Dolichurus stantoni,* of which about a dozen pairs were liberated in July and September 1917 to destroy cockroaches, is now found in abundance on cane trash and it is thought to be breeding on *Phyllodromia hieroglyphica* and *Loboptera extranea.*

With the exception of a few plantations the damage from leaf-hoppers [*Perkinsiella saccharicida*] has also been greatly reduced. Observations were made to estimate the percentage of parasitism in different regions, and the results were very variable A high percentage of parasitism does not necessarily mean successful control of the pest, as it usually occurs when, owing to favourable conditions, the numbers of eggs laid by the leaf-hoppers is greatly increased. The artificial distribution of *Paranagrus* [*optabilis*] and the Formosan species of *Ootetrastichus* is being continued on a large scale, amounting during the year to 78 colonies with a total of 29,010 adults of the latter. Owing to the establishment of *Ootetrastichus* in the field, rearing of this egg-parasite in cages has been discontinued. Other leaf-hopper enemies include a fungus, *Entomopthora* sp., which is responsible for the destruction of great numbers, but is unfortunately very difficult to handle in culture, and attempts to grow it artificially have failed.

In the course of the discussion following the reading of this report, it was stated that the cultivation of the variety of sugar-cane known as H109 is largely replacing that of other varieties on the Island, but its chief disadvantage is the attraction it has for leaf-hoppers, although these insects do not cause serious damage unless their attack is combined with eye-spot disease. To increase the resisting power of the cane, Mr. Swezey suggested planting as early as July, and it is probable that fertilisers are better withheld during the first summer, especially if early planting has not been possible.

The damage from cane-borer [*Rhabdocnemis obscura*] was very small in comparison with previous years, the Tachinid parasite [*Ceromasia sphenophori*] now being well established.

The cane aphis appeared as usual in many places, and although its ravages are not to be compared with a leaf-hopper outbreak, it is strongly recommended to attempt the introduction of more natural enemies of this pest.

Nematodes do not cause serious damage to sugar-cane, although the stunted growth of the Lahaina variety may be partly due to their action, but they have been found infesting other crops such as potatoes, beet, etc., in much greater numbers than in previous years. The Italian lupin and a variety of beans greatly encourage the spread of this pest.

SAVASTANO (L.). **Talune Notizie sul Novius e l'Iceria riguardanti l'Arboricoltore.** [Some Notes for the Fruit-grower relating to *Novius cardinalis* and *Icerya purchasi*.]—*Boll. R. Staz. Speriment. Agrum. Fruttic., Acireale*, no. 32, April 1918, 2 pp., 2 figs., 1 plate. [Received 30th July 1919.]

This bulletin supplies the fruit-grower with the elementary information required for employing the Coccinellid, *Novius cardinalis*, against the scale, *Icerya purchasi*.

DE STEFANI (T.). **Intorno agli Insetti che frequentano i Fichi ammalati di Seccume nella Provincia di Palermo.** [The Insects found on Fig-Trees suffering from Withering in the Province of Palermo.]—*Annali R. Staz. Speriment. Agrum. Fruttic., Acireale*, iv, 1916–1918, pp. 1–5. [Received 30th July 1919.]

Investigations were made to ascertain whether the bacteria causing a withering disease of fig-trees in the Province of Palermo are distributed by insects. The following species were observed: Coleoptera:—*Sinoxylon sexdentatum*, Oliv., and *Denops albofasciatus*, Charp., both very common; Hymenoptera:—*Vespa crabro*, L., and *V. germanica*, F.; Lepidoptera:—*Cossus cossus*, L.; Diptera:—*Musca domestica* and *Platystoma umbrarum*, F.; Rhynchota:—*Piezodorus incarnatus*, Germ., *P. incarnatus* var. *alliaceus*, Germ., and *Ceroplastes rusci*, F. It would appear that the two last-named and especially the wasps and flies are capable of disseminating the disease, but this is still open to question.

DE STEFANI (T.). **I Zoocecidii del Nocciuolo** (*Corylus avellana*, **L.**) **in Sicilia.** [The Insect-galls of the Hazel in Sicily.]—*Annali R. Staz. Speriment. Agrum. Fruttic., Acireale*, iv, 1916–1918, pp. 171–186, 1 plate.

The damage done to the hazel by gall-forming insects is increasing in Sicily. The injury consists in a deformation of the buds which either prevents or modifies the development of leaves and flowers. A mite, *Eriophyes coryligallarum*, Can., is responsible for this injury. Among its natural enemies are *Arthrocnodax* spp., *Tyroglyphus minutus*, Targ., *Caligonus virescens*, Targ., and *Gamasus vepallidus*, Koch. These natural checks have not however proved sufficient, and spraying

with the Savastano formula for lime-sulphur [see this *Review*, Ser. A, ii, p. 412] is advised. At the strength of 1–5 per cent. it was found to be harmless to the plants and very efficacious against the *Eriophyes* if applied three times, at the beginning, middle and end of May. A 4 per cent. solution is the best. Spraying must be done for 2 or 3 consecutive years and the affected buds must be collected and destroyed during the autumn and up to the following April.

BALLOU (H. A.). **Report by the Entomologist on a Visit to the Northern Islands (St. Kitts-Nevis, Antigua, Montserrat).**—MS. received from Colonial Office 6th August 1919.

Hardback grubs still continue to be a serious pest of sugar-cane and other crops in Antigua. The grubs feed most actively from July or August to January and February, pupate about March or April, and emerge as adults with the early rains of April or May. Oviposition probably occurs from May or June to July or August. The preferred food-plants are newly-planted sugar-cane, maize, onions, sweet potatoes and yams. The insects do not remain in the same field year after year, but migrate to others; as a rule ratoon crops are more severely attacked than plant canes. The beetles upon emerging from the soil appear to be attracted to trees or bushy plants where feeding and mating take place at night, and if they emerge in a field from which the canes have been cut, they will fly off to another field, while if canes are still standing they may stay and reinfest the same field again. This would explain why the attack is experienced in different fields in different seasons, and also why certain fields from which canes have been reaped are so badly infested that it is most difficult to establish the next crop, whether of cane, maize or onions. The numbers of grubs in the soil can be much reduced at this time by hand-collection, which may be greatly facilitated by the use of a trap-crop, such as maize, that will attract them to its roots which lie near the surface.

In Mauritius *Phytalus* [*smithi*] is captured by means of traps consisting of leafy branches of bushes or trees stuck in the soil from which the beetles are emerging. Having climbed up on these branches to feed at night, the beetles can be searched for with lights and captured in enormous numbers. *P. smithi* is also collected in Barbados in very large numbers on canes, pigeon peas and other plants.

In Antigua, the scarcity of bush would render this practice difficult, but if maize were planted in an infested field as soon as the canes were cut and early enough to be well established by mid-April many beetles might be collected on the plants. Beetles emerging from early-cut fields, reaped about April, generally fly away from that field, and crops planted in the following months should be free from infestation; while if the canes are reaped in June or later, the crops following them will be liable to attack. If this proves to be correct, it would be a good practice to allow canes to stand until after emergence of the beetles, so that they may deposit eggs in the same field. The canes might then be cut and the land worked and planted with maize; when this is attacked it should be pulled up, the grubs collected from the soil and maize planted again. If the second crop is attacked the pulling up and collecting should be repeated. These

recommendations are given from the point of view of grub control; practical financial considerations may require the early harvesting and milling of badly attacked canes in order to avoid loss in weight and quality of the cane. The planter must decide which course to follow. Maize grown as a trap-crop for grubs should not be expected to yield grain, and all the plants, not only the obviously injured ones, should be pulled up.

Although wild birds feed upon the grubs, they are not likely to be present in Antigua in sufficient abundance to exert much influence on their numbers; the common Gaulding is however abundant in certain localities and is worthy of protection. Parasites in Antigua seem to be of little value, but even when present in abundance the control exerted by natural enemies is only partial. In Barbados, *Phytalus* [*smithi*] is parasitised by *Tiphia* [*parallela*], but the control is so incomplete that the pest is spreading and the damage increasing year by year.

The influence of root disease in cane injury is discussed [see this *Review*, Ser. A, vii, p. 335] and the crop system practised in Antigua is described. The importance of drainage as a fundamental in agricultural practice for the production of vigorous, healthy plants is also insisted upon.

Cotton in Antigua has been seriously attacked by cotton-stainers [*Dysdercus*] during the past season and in many localities by the flower-bud maggot [*Contarinia gossypii*], which appeared about October and seriously affected the production of flowers and bolls for some time. The stainers induced serious attacks of internal boll disease during the latter months of the year. The campaign against the wild food-plants of the stainer is being carried on. In St. Kitts and in Nevis the cotton-stainers left the cotton fields in swarms, flying to the mountains. When followed up they were found in only one locality, at an elevation of 800 ft., where small colonies occurred among grass and other plants. These were found near to two silk cotton trees, which however had no pods. The fields that the stainers had left were very hot and dry and it seems probable that they had migrated in search of cooler and more moist conditions. In the case described the small number of stainers found would have little bearing on the infestation of fields in the coming season, but if the silk-cotton trees on the mountains produced seeds in abundance and the weather conditions were suitable for the stainers to breed, a very large number might develop. These observations indicate that careful watch will have to be kept on these haunts of *Dysdercus* in the mountains in connection with the attempt to control the pest by the destruction of the wild food-plants.

The attacks of the cotton worm [*Alabama argillacea*] in Nevis were sufficiently serious to necessitate a special investigation [see this *Review*, Ser. A, vii, p. 372]. An attempt was made to introduce *Polistes annularis* (Barbados wild bee) into Antigua and Nevis to destroy the caterpillars of this moth, but the experiment was not satisfactorily carried out and cannot be considered conclusive. It will probably be repeated, but it is evident that precautions will have to be taken against introducing with these wasps a Pyralid moth, *Dicymolomia pegasalis*, that infests their nests [see this *Review*, Ser. A, iii, p. 736].

TILLYARD (R. J.). **Studies in Australian Neuroptera No. 7. The Life History of** *Psychopsis elegans* **(Guérin).**—*Proc. Linnean Soc. N.S.W., Sydney*, xlii, part 4, no. 172, 26th March 1919, pp. 787–818, 1 plate, 12 figs.

The complete life-cycle of *Psychopsis elegans*, Guér., occupies about two years. The eggs are laid in January or February in clusters upon the bark of Myrtaceous trees, especially *Eucalyptus*. The larvae hatch in about 12 days and at once hide in cracks of the bark. They have 3 instars lasting 8 months, 4 or 5 months and 9 months respectively. During the first instar hibernation occurs from February to September, and during the third, from March to November. The food of the larvae consists of the various insects that appear at night to feed on the gum of the tree. In captivity they thrive best during the first instar on termites and later on larvae of the codling moth [*Cydia pomonella*]. Pupation occurs in a cocoon and lasts about 3 weeks, the imago emerging about December.

If it were possible to transfer these insects to apple, pear or quince orchards, they should prove a most valuable asset in the control of Lepidopterous pests. Further investigations as to this possibility are advised.

HAYWARD (H. C.). *Sesia asiliformis* **feeding in the Wood of Birch in company with** *S. culiciformis*.—*Entomologist, London*, lii, no. 675, August 1919, p. 190.

Aegeria (*Sesia*) *asiliformis* is recorded in June as feeding not only in the bark but also in the wood of a birch log.

LEES (A. H.). **The Buff-tip Moth,** *Pygaera* (*Phalera*) *bucephala*.—*Gardeners' Chronicle, London*, lxvi, no. 1703, 16th August 1919, pp. 96–97, 1 fig.

A brief and popular account is given of the life-history and habits of *Pygaera* (*Phalera*) *bucephala*, which may be found on elm, lime, hazel, willow, oak, birch, beech, alder, sycamore and sometimes on roses. It is easily controlled by hand-picking or spraying with lead arsenate.

SHUFELDT (R. W.). **Insects in their Relation to Forestry.**—*American Forestry, Washington, D.C.*, xxv, no. 307, July 1919, pp. 1221–1225, 6 figs.

A general outline is given of injury to forest trees by insects, those dealt with including: *Citheronia regalis*, F. (royal walnut moth), the caterpillar of which feeds on the leaves of butternut, hickory, persimmon, sumach (*Rhus*), sycamore and walnut; and a Cerambycid beetle, *Prionus laticollis*, infesting the trunks and roots of poplar and black oak trees.

WATSON (J. R.). **New Thysanoptera from Florida,-IV.**—*Florida Buggist, Gainesville*, ii, no. 3, December 1918, pp. 97–102. [Received 6th August 1919.]

Additions to the list of Thysanoptera recorded from Florida [see this *Review*, Ser. A, vi, p. 505] include *Trichothrips brevitubus*, sp. n.,

and *Megalomerothrips eupatorii*, gen. et sp. n., which are here described. Keys to the North American species of *Trichothrips* and the genera of PHLOEOTHRIPIDAE are also given.

WATSON (J. R.) & OSBORN (E.). **Additions to the Thysanoptera of Florida,-V.**—*Florida Buggist, Gainesville*, ii, no. 4, March 1919, pp. 116–119. [Received 6th August 1919.]

The additional species recorded are *Haplothrips orlando*, sp. n., here described, and *Frankliniella insularis*, Frankl., on flowers of *Citrus* and *Carissa grandiflora*. A key is also given to the North American species of *Haplothrips*.

Attention is called to the fact that *Anthothrips niger*, Osb., is a synonym of *Haplothrips statices*, Hal.

WATSON (J. R.). **Additions to the Thysanoptera of Florida,-VI.**—*Florida Buggist, Gainesville*, iii, no. 1, June 1919, pp. 2–7. [Received 26th August 1919.]

The species described include:—*Dictyothrips floridensis*, sp. n., taken on guava plants, and *Cephalothrips elongata*, sp. n., taken from a barnacle scale (*Ceroplastes cirripediformis*).

A key is also given to the American species of *Frankliniella*.

WATSON (J. R.). **Onion Thrips.**—*Florida Univ. Agric. Expt. Sta., Gainesville*, Press. Bull. no. 290, 4th April 1918, 2 pp. [Received 6th August 1919.]

This bulletin, the bulk of the matter of which has been previously noticed [see this *Review*, Ser. A, v, p. 186] gives a brief description of the damage caused by *Thrips tabaci* (onion thrips) in Florida. Various sprays as well as crop rotation are advocated as remedial measures.

WATSON (J. R.). **The Fall Army Worm, or Grass Worm.**—*Florida Univ. Agric. Expt. Sta., Gainesville*, Press Bull. no. 293, 25th July 1918, 2 pp. [Received 6th August 1919.]

A brief description is given of the fall army worm [*Laphygma frugiperda*] and its life-history.

The remedial measures advocated are the use of poison-baits, sprays or dust. The poison-bait, which should be made fresh each day, consists of 20 lb. of bran, 5 lb. of cottonseed meal and 1 lb. of Paris green mixed with 3 or 4 finely chopped lemons and $2\frac{1}{2}$ U.S. gals. of water to which 2 U.S. qts. of molasses or syrup should be added, the whole being well mixed to a consistency which will fall in fine flakes when scattered. Oranges or grapefruit may be used, but lemons or limes are preferable. Additional bran may also be substituted for the cottonseed meal. This quantity is sufficient for 4 to 5 acres. The sprays recommended are 1 lb. of Paris green, 2 lb. of lime and 150 U.S. gals. of water, or 3 or 4 lb. of lead arsenate paste to 100 U.S. gals. of water. Half this quantity will be required if the powdered form is used. As a dusting powder 1 lb. of Paris green may be used with 50 lb. of flour or lime.

WATSON (J. R.). **Sweet-Potato Caterpillars.**—*Florida Univ. Agric. Expt. Sta., Gainesville,* Press Bull. no. 304, 22nd February 1919. 2 pp. [Received 6th August 1919.]

Many caterpillars, including the semi-tropical army worm [*Xylomyges eridania*], are injurious to sweet potato plants in Florida in July, August and September. The remedial measures advocated, including poison-baits, spraying and dusting, are practically the same as those for *Laphygma frugiperda* (fall army worm) [see preceding paper].

WATSON (J. R.). **Florida Truck and Garden Insects.**—*Florida Univ. Agric. Expt. Sta., Gainesville,* Bull. 151, February 1919, 211 pp., 57 figs. [Received 6th August 1919.]

The bulk of the matter contained in this bulletin, which is a revision of an earlier one, has previously been noticed [see this *Review*, Ser. A, v, p. 305]. Further experiments made with regard to remedial measures for root knot disease show that complete fallowing during one summer will exterminate the Nematode [*Heterodera radicicola*]. Other measures advocated are sprinkling with sodium cyanide, dissolved in water, at the rate of 600 lb. per acre, after which the soil should be well saturated with water to a depth of at least 18 inches; this is followed by a sprinkling of ammonium sulphate at the rate of 900 lb. per acre and applied in the same manner. Carbon bisulphide has proved efficacious when applied at the rate of one ounce poured into holes 12 to 18 inches deep near the base of the plants and immediately covered to prevent the escape of gas. One side of the plant should be treated first, and the other side a week or two later.

The insect pests dealt with include :—*Stictocephala festina* (three-cornered alfalfa hopper), which infests beans, tomatoes, watermelons, cowpeas and many other plants; *Peregrinus maidis* (corn leaf-hopper), which becomes very abundant in the latter part of August, causing the death of young maize and may be controlled by sprays of tobacco extracts and early planting; *Leptocorisa tipuloides* (crane-fly bug) which attacks egg-plants and may be killed by a solution of 5 lb. of soap, ½ pt. of Blackleaf 40 to 50 U.S. gals. of water; *Geocoris punctipes*, a bug that attacks lettuce in the winter, the spray advocated for it being 2 lb. of lead arsenate and ⅗ of a pint of Blackleaf 40 in 50 U.S. gals. of Bordeaux mixture; *Pseudococcus citri* attacking potatoes stored in dry places; and *Termes flavipes* infesting sweet potatoes.

Sunflowers have been used successfully as a trap-crop round potatoes for the bug, *Leptoglossus phyllopus*. Strawberries have been attacked by the strawberry flea-beetle (*Haltica ignita*), and planting crape myrtle [*Lagerotroemia indica*] as a trap-crop is suggested, this being its favourite food-plant.

WATSON (J. R.). **Report of Entomologist.**—*Rept. for the Fiscal Year ending 30th June, 1918 Florida Univ. Agric. Expt. Sta., Gainesville,* May 1919, pp. 56R.—61R. [Received 6th August 1919.]

The insects pests reared include a bug, *Adelphocoris rapidus*, puncturing squares and young bolls of cotton in July, causing them

to drop; *Epicaerus formidulosus* (broad-nosed weevil), specially abundant and attacking foliage of cotton and tobacco and also injuring beans; a large yellow bug, *Spartocera* (*Corecoris*) *confluenta*, causing severe injury to tomatoes; *Leptinotarsa decemlineata* (Colorado potato beetle), reported for the first time from the Gulf Coast of Florida and apparently spreading southward; a Membracid, *Platycorus quadrivittata*, which was more common than usual, mainly infesting oaks; and *Derelomus basalis* (papaw weevil), injuring cotton squares in June and also taken on beans.

Several hundred individuals of the Coccinellid, *Delphastus catalinae*, were imported from California and liberated in different parts of the State, where it seems likely that they will become established.

Nezara viridula (pumpkin bug) was less destructive during the autumn of 1917 than during 1916. It has been ascertained that hibernation is incomplete. Some individuals can be found under loose bark of dead trees, but others remain all the winter on green plants feeding actively, although quiescent during the coldest months. The nymphs become adults about the middle of November, and no breeding takes place until late in the following February. The radish is the preferred food-plant, especially when seed pods are present, but serious damage is also caused to tomatoes. The planting of radishes as a trap-crop round the edges of tomato fields is suggested.

Experiments to control Nematodes, by means of the application of calcium cyanamide to the soil, have been continued. Complete eradication was not effected, but the numbers were greatly reduced. For reasons as yet unexplained, the application of one ton per acre caused scorching of the crops in some cases, whereas on other plots 3 tons per acre were used without any ill effects. With cyanide-ammonium sulphate there is less danger of injury to crops, and the effect on Nematodes is practically the same. Experiments were made using 100 to 800 lb. per acre in solution or powder form over the entire surface of the soil. With the use of 300 lb. or less there was no appreciable decrease in the numbers of Nematodes, but the growth of plants on lots thus treated was considerably increased.

Summer fallow resulted in the same reduction of Nematodes as when 600 lb. of cyanide or one ton of cyanamide was used per acre, and it would seem that better results would be obtained from the growing of resistant plants on infested soil if the surface was frequently stirred. For this reason it is suggested that cowpeas and velvet beans should be planted in rows, and experiments are now being conducted on these lines.

Schøyen (T. H.). **Beretning om Skadeinsekter i Land- og Havebruget i 1917.** [Report on Agricultural Insect Pests in 1917.]—*Christiania*, 1918, 73 pp.

Of the numerous insects recorded in this paper the following are the principal ones of economic importance. In Hedemarken numerous barley fields were completely devastated owing to a combined attack of *Oscinella frit*, L., *Miris dolabratus*, L., *Pediculoides graminum*, E. Reut., and a fungus, *Pleospora teres*. *M. dolabratus* is a new pest to Norway. *Anthonomus pomorum* was very common in 1917, and it was proved by experiments that the greater part of the weevils

could be collected by banding the trees in July, showing that they retire to their hibernating quarters early in the season. The investigations on *Taeniothrips inconsequens*, Uzel, were continued, the English "XL All" insecticide paste being very effective against this thrips.

SCHØYEN (T. H.). **Kornsygdome paa Hedemarken.** [The Diseases of Barley in Hedemarken, Norway.]—*Tidens Tegn, Christiania*, 1918, nos. 232, 235, 269.

The devastation of the barley fields recorded from Hedemarken in 1917 continued and increased in 1918. About 75 per cent. of the injury was caused by *Oscinella (Oscinis) frit*. Late sowing of spring barley has been found an advantage, and the author recommends the sowing of trap-crops in strips in order to collect the larvae of the second generation.

BOAS (J. E. V.). **Aedelgranslusene.** [The Aphids of the Silver Fir.] —*Dansk Skovforenings Tidskrift, Copenhagen*, iii, 1918, pp. 191–276, 51 figs.

This paper deals with *Chermes piceae* and *Mindarus abietinus*, with special regard to the injuries caused by them. Regarding *C. piceae* the author is of opinion, contrary to Börner, Marchal and Nüsslin, that *C. piceae* and *C. nüsslini* are not distinct, but only biological races of the same species.

In Denmark *C. piceae* is to a great extent an enemy of young silver fir trees, killing them or impairing their vitality. In many instances it only kills the terminal shoots, thus reducing the quality of the timber. Its attacks frequently diminish gradually, the insect becoming scarcer from year to year; but in localities where the soil is not favourable to the cultivation of the silver fir, the attacks may continue to such an extent that the plantations suffer seriously.

Mindarus abietinus does not affect the general health of the trees to the same extent as *C. piceae*, confining its attacks chiefly to the terminal shoots, which break off. This injury occurs on old as well as on young trees and is often repeated, causing the trees to bend and reducing the value of the timber.

As remedial measures spraying with lysol solution or quassia and thorough thinning of the plantations are suggested.

LJUNGDAHL (D.). **Lepidopterologiska Anteckningar.** [Notes on Lepidoptera.]—*Entomologisk Tidskrift, Stockholm*, xxxix, no. 1, 1918, pp. 82–91, 4 figs.

This paper contains the following records of ICHNEUMONIDAE and Tachinid flies reared from Lepidoptera: *Trogus exaltatorius*, Panz., from the pupa of *Dendrolimus pini*, L.; *Ichneumon extensorius*, L., from pupae of *Polia (Mamestra) advena*, Schiff.; *Bucentes cristata*, F., from the larvae of *Polia suasa*, Schiff. (*Mamestra dissimilis*, Knoch), and *Exorista vulgaris*, Fall., from cocoons of the same species; *Banchus volutatorius*, L., and *Exetastes cinctipes*, Retz., from the pupae of *Polia suasa* and *P. (M.) contigua*, Schiff.; *Ichneumon extensorius*, L., *Campoplex remotus*, Frst., and *Platylabus dolorosus*, Wsm., from *Lygris testata*, L.; *Microgaster calceatus*, Hal., from *Larentia*

juniperata, L.; *Cryptopimpla errabunda*, Grav., from *Larentia cucullata*, Hufn.; *Pimpla arctica*, Zett., and *Ichneumon captorius*, Thoms., from the pupae of *Gnophos myrtillata*, Thunb.

AHLBERG (O.). **Beiträg zur Deutung der Zetterstedtschen Thrips-Arten.** [Contributions towards the Interpretation of the Thysanoptera described by Zetterstedt.]—*Entomologisk Tidskrift, Stockholm*, xxxix, no. 2, 1918, pp. 140–142.

Examination of the type of *Thrips picipes*, Zett., described by Zetterstedt in "Insecta Lapponica," and still preserved in the entomological collections at Lund, has elicited the fact that this species is identical with *Taeniothrips primulae*, Hal.

WAHLGREN (E.). **Ueber *Musca pumilionis*, Bierkander.**—*Entomologisk Tidskrift, Stockholm*, xxxix, no. 2, 1918, pp. 134–139.

In modern entomological literature this species is referred to the genus *Siphonella*, while in the earlier Swedish literature on economic entomology it is referred to the genus *Chlorops*. The author expresses the opinion that it is identical with *Chlorops taeniopus*, Meig., while *Oscinis pumilionis*, Fall., and Zett., which was wrongly supposed by these authors to be identical with *Musca pumilionis*, Bierk., is a *Siphonella*, which must bear the name *S. pumilionis*, Zett.

TULLGREN (A.). **Några ord om Förödelse på Vetefalten inom Götaland.** [Some Remarks on the Devastation of the Wheat-fields in Gotland.]—*Tidskrift för Landtman*, 1918, nos. 24, 31, 33, pp. 397–398, 504–507, 4 figs.

An account is given of an outbreak of *Cicadula sexnotata*, with illustrations of the developmental stages and the injury caused. The insects were so numerous that a net, moved ten times to and fro in a field, collected 7,000 individuals. The leaves of the wheat were at this time, the end of June, quite withered. In July the insects migrated to late sown oats and barley. Their local occurrence was very remarkable, one field being frequently completely devastated, while another close by escaped injury, the field which escaped being as a rule that which had been sown late, while early sown fields were attacked. This is explained by the assumption that the oviposition period of the insect coincided with the time when the wheat appeared above the ground in the previous autumn. The remedial measure suggested is the collection of the larvae and nymphs by means of nets.

ÅKERMAN (Å.). **Angrepp av Vetemygglarver på Vårvete Sommaren 1917.** [Injuries caused by the Wheat Midge on Spring Wheat during the Summer of 1917.]—*Sveriges Utsädesförenings Tidskrift*, 1918, pp. 90–93.

This investigation on *Contarinia tritici* is a continuation of researches on this pest published in 1917 [see this *Review*, Ser. A, vi, p. 151]. As already observed by the author in the case of autumn wheat, the spikes that are most dangerous are those that are bursting when

the midges are swarming in the greatest numbers. This depends on the fact that the insects preferably oviposit on the spikes when they are bursting, whereas fully developed spikes are seldom attacked. On an average 5 per cent. of the flowers were destroyed by this pest.

TRÄGÅRDH (I.). **Redogörelse för det Entomologiska Laboratoriets Verksamhet under 1915-1917.** [Report on the Investigation of Forest Insects during 1915–1917 at the Entomological Laboratory of the Swedish State Institute of Experimental Forestry.]—*Meddelande från Statens Skogsförsöksanstalt, Stockholm,* Häfte 15, 1919, pp. 154–174, 5 figs.

In investigations on the pine beetles (*Myelophilus piniperda* and *M. minor*), the problems that have been studied include the influence of the size of the felled trees on the development of the brood, the ability of the beetles to disperse, the influence of the time when the trees are cut and the consequent injury to the trees caused by the beetles when feeding. It was found to be correct that the beetles will oviposit on trees measuring less than 1¼ inches at the base, but that the larvae are unable to complete their metamorphosis owing probably either to the small space at their disposal, or to the too rapid drying of such slender stems. In larger trunks, however, the number of imagines that develop rapidly increases, being about 15 per each egg-gallery in trees of a diameter of 2¾ inches. Consequently, when thinning the forest, the smaller trunks may be left without any danger of the beetles increasing in number. When the beetles leave the trunks in order to feed on the shoots, they invariably choose the nearest trees. The damage to the crowns of pine trees is therefore usually concentrated round the localities where the beetles have bred. As regards the effect of the date of cutting the trees, it was found that there is a period of at least two months during the summer when the pine trees may be felled and left in the forest without any protective measures being taken, such as removal of the bark. This is due on the one hand to the fact that the pine beetles swarm early in the spring and only have one generation a year, the trees felled after the swarming is over consequently escaping oviposition, and on the other hand to the fact that trees felled during the earlier half of the summer do not attract ovipositing beetles in the following spring. The measurements taken in order to ascertain whether the injury caused to the shoots results in reduction of the growth of the trees failed to show any decrease. In the cases investigated, however, the attack had only taken place during one year. Investigations on the spruce bark-beetle (*Ips typographus*) and on the enemies of spruce-cones have already been noticed [see this *Review*, Ser. A, vi, pp. 90, 287].

TRÄGÅRDH (I.). **Skogsinsekternas Skadegörelse under År 1917.** [The Injuries caused by Insects to Swedish Forests in 1917.]—*Meddelanden från Statens Skogsförsöksanstalt, Stockholm,* Häfte 16, no. 4, 1919, pp. 67–114, 14 figs.

The birch bark-beetle (*Scolytus ratzeburgi,* Jans.) does not seem to play any important part in Sweden, as a rule attacking only isolated trees. At Vaesby in Oland, however, in 1915, about 500 birches were so severely injured that they had to be cut down. An investigation

made in 1917 failed to elucidate the cause of the outbreak, but revealed the fact that in many instances the attack had failed owing to the resistance offered by the trees, the larval galleries being only very short. Another bark-beetle (*Ips acuminatus*, Gyll.) is one of the commonest species in the north of Sweden, occurring in trees with thin bark, and seems in this part of the country to replace *Myelophilus minor*, which also prefers the thin-barked portions of pine trees. There is, however, a great difference between the two species in so far that *Ips acuminatus* oviposits in branches measuring as little as $\frac{1}{2}$–$\frac{3}{4}$ inches in diameter, whereas *Myelophilus* does not do so in branches of less than about $1\frac{1}{2}$ inches. The practical consequence of this is that the increase of the former species is favoured by the smaller branches being left on the ground.

The adult moths of *Bupalus piniarius* L., are very susceptible to rain, being often drowned in great numbers. An example of this occurred at Tuna in 1916. In the beginning of July enormous numbers of the moths were noticed. An investigation made at the end of July, however, elicited the fact that hardly any eggs had been laid, which was explained by the torrential rain on the 6th July, when nearly $2\frac{1}{2}$ inches fell in a single shower. The number of eggs laid on each needle is said generally to be about 7, larger numbers up to 30 having also been found. An investigation made at Sorby in Sodermanland showed that on most needles only 2–4 eggs occurred, 7 or more being very seldom found, though it is impossible to say whether this is the rule in Sweden, the number of eggs laid on each needle being probably influenced by climatic conditions. The larvae always begin feeding at the top of the trees, probably because the eggs are chiefly deposited there, and therefore, at least during the first year of an outbreak, it is easy to discern a very badly defoliated upper part of the crown, whereas in the lower parts there is hardly any damage at all. As a rule an outbreak reaches its climax in the second year and ceases during the third year, and it is the general opinion of entomologists that parasites are the controlling factor. Even if this may be to some extent an exaggeration, in so far that climatic conditions may also play a part, a study of the parasites during an outbreak is of very great interest both from a theoretical and a practical point of view. The outbreaks in different parts of Sweden have therefore during the last years been studied with special regard to parasites, the time permitting only the investigation of those species that are found in the pupae in the spring. In Sorby in 1917 nearly 100 pupae were found per square metre, 18 per cent. of which were parasitised. In 1918 only 8·8 pupae were found per square metre, 60 per cent. of which were parasitised, which shows the important part played by the parasites. Both flies and Ichneumonids were reared from the pupae. Besides *Barichneumon locutor*, Thunb., and *Cratichneumon nigritarius*, Grav., which were reared from the pupae, *Plectocryptus arrogans*, Grav., a species reared in north Germany from pupae of *Bupalus piniarius* was taken in one of the forests where an outbreak occurred.

In order to study the effect of the injury on the trees several plots were laid out, the trees on which were repeatedly examined. At Sorby in the spring of 1918 no pine tree had succumbed to the attacks of the two previous years, in 4 per cent. of the trees *Myelophilus*

piniperda was breeding, and in 10 per cent. it had tried in vain to oviposit. This seemed to indicate that these trees had suffered to such an extent from *B. piniarius* that they had become attractive to the pine beetle. A closer investigation however showed that this was not the case, only 1 of the 14 trees most seriously defoliated by *Bupalus piniarius* having been attacked by the pine beetle, and that in vain. Furthermore, one of the trees which in 1918 was attacked by the pine beetle had during the two previous years escaped the attack of *Bupalus piniarius*. As a matter of fact the moth concentrates on the largest trees, whereas the pine beetle prefers the smaller ones. The results obtained during recent years in Sweden regarding *B. piniarius* seem to make it clear that no precipitate measures, such as cutting the timber, should be taken, as it often happens that the trees do not succumb to the attack.

Although there are four species of the genus *Cephaleia*, in Sweden no records of any damage by these sawflies has previously been recorded. In the summer 1916, however, at Dalby near Lund an attack on spruce trees due to *C. signata*, F., was observed, the area in which the injury occurred being 12½ acres, and the following year increasing to about 185 acres. An investigation made in the autumn of 1917 showed that 300–400 larvae were to be found in the ground. In 1917 the swarming took place in the end of May. The eggs are deposited singly on the old needles and are of a grey-green colour. The young larvae emerged in the middle of June, but a large number of the eggs (about one-third) were parasitised by a Chalcid, probably *Entedon ovulorum*, a species reared by Ratzeburg from the egg of *Lyda pratensis*.

TRÄGÅRDH (I.). **Barrträdskvalstret en Fiende i våra Plantskolor.** [The Pine-tree Spinning Mite, *Paratetranychus ununguis*, Jac., an Enemy in our Nurseries.]—*Statens Skogsförsöksanstalt, Stockholm*, Flygblad no. 14, 1919.

Attention is called to the injury caused by this mite in nurseries. The damage done as a rule passes unnoticed, the mite being too small to be recognised as the cause. Near Västervik, in Sweden, an attack on 3–4 year old spruce trees was noticed in May 1918, which would doubtless have caused the death of the plants unless the pest had been detected and measures taken against it. The plants at this time were of a red colour and covered with hibernating eggs. They were sprayed with lime-sulphur, with the result that the mites were killed and the plants saved.

FRIEDERICHS (K.). **Können schädliche Insekten durch parasitische Pilze bekämpft werden?** [Can harmful Insects be combated by Fungus Parasites?]—*Mitt. Naturf. Ges. in Bern*, 1918, pp. xv–xvi, (1919).

After recording some of the more successful instances of attempts to control insect pests by means of fungi, the author describes his own experiments with *Metarrhizium anisopliae* in Samoa, where the imported beetle, *Oryctes rhinoceros*, does tremendous damage to coconut palms. Heaps of decomposing vegetation, treated with the fungus, were placed so that the beetles should lay their eggs there, with the result that all the larvae hatching out were destroyed. He

also succeeded in infecting, in the laboratory, many other insects besides *O. rhinoceros* with *M. anisopliae*, whence it might be inferred that this fungus should be useful against other pests, but only in countries with a warm, damp climate.

Baker (C. F.). **Mango Pests in Singapore.**—*The Gardens' Bull., Straits Settlements, Singapore*, ii, no. 4, 4th July 1919, pp. 115–116.

The inferior quality and quantity of Singapore mangos is partly due to the ravages of a Psyllid which produces numerous galls on the leaves. The honey-dew secreted by these insects probably accounts for the growth on the foliage of a sooty black fungus (*Meliola mangiferae*).

Corporaal (J. B.). **Notiz über die beiden Roepke' schen Gambirschädlichen Capsiden.** [A Note on the Gambir-infesting Capsids described by Roepke.]—*Tijdschr. Entomologie, The Hague*, lxii, no. 1–2, 15th July 1919, pp. 107–108.

This note supplements Roepke's description of *Helopeltis sumatranus* and *Hyalopeplus uncariae* [see this *Review*, Ser. A, iv, p. 481] injuring *Uncaria gambir* in Sumatra. *H. sumatranus* is the more important species [see this *Review*, Ser. A, vi, p. 38].

Velu (H.). **La Lutte contre les Acridiens au Maroc. Troisième Campagne d'Expérimentation de la Méthode biologique.**—*Bull. Soc. Path. Exot., Paris*, xii, no. 7, 9th July 1919, pp. 362–364.

Further experiments made to control *Schistocerca peregrina*, Ol., by the biological method confirm the results obtained in 1916 [see this *Review*, Ser. A, v, p. 99] viz. :—That the end of the 3rd instar is the most favourable time for contamination and practically the only susceptible period. This method is still in the experimental stage and can certainly not be considered of any great economic importance at present, as its application is too restricted. It is suggested that the State should undertake measures to insure the destruction of locusts immediately upon the appearance of invading swarms in the South, as one individual destroyed then implies the suppression of 500 to 1,000 later. This may be done by various methods. all of which should be employed at night.

Dufrenoy (J.). **Les Mycoses momifiantes de Chenilles processionnaires des Pins d'Arcachon.**—*C.R. Soc. Biol., Paris*, lxxxii, no. 24, 26th July 1919, pp. 962–963.

The action of *Beauveria* spp. on *Cnethocampa pityocampa* [see this *Review*, Ser. A, vii, p. 385] is further dealt with and the process of mummification is described.

GAUTIER (C.). **Recherches physiologiques et parasitologiques sur les Lépidoptères nuisibles. Parthénogenèse chez *Apanteles glomeratus*, Linné.**—*C.R. Soc. Biol., Paris*, lxxxii, no. 24, 26th July 1919, pp. 1000–1002.

The author has established, by experiments described in detail, the existence of parthenogenesis in *Apanteles glomeratus*, L., the Braconid parasite of *Pieris brassicae* [see this *Review*, Ser. A, vii, p. 397]. This probably occurs but rarely under natural conditions, but it is phenomenon that might be of great importance in some cases.

PICARD (F.). **Sur deux Cécidomyies du Midi de la France.** [Diptera.] —*Bull. Soc. Entom. France, Paris*, 1919, no. 11, 11th June 1919, pp. 207–208. [Received 8th August 1919.]

The galls formed by *Putoniella marsupialis*, F. Löw, on the under-side of leaves of *Prunus spinosa*, *P. insititia* and *P. domestica* are described. The insects occur abundantly but only in certain localities. They are not found on blackthorn in roadside hedges, probably on account of the dust, but only at some distance from any highroad. *P. marsupialis* is highly parasitised by a number of Chalcids, the chief of which is *Torymus exilis*, Wlk., which also parasitises *Perrisia asperulae* and *Rhopalomyia artemisiae*.

Galls are produced on the leaves of the cultivated violet by *Perrisia affinis*, Kieff. Similar galls have been observed on several species of *Viola* in Europe and Northern Africa, but do not seem to have been noticed hitherto in France. In some cases all the leaves are rolled and the flowers do not develop. Transformation takes place within the gall. Another Cecidomyid, *Contarinia violicola*, Coq., attacks violets in North America, rolling the leaves in exactly the same way. This species is treated with sprays of freshly-slaked lime, a remedy that might be tried against the species occurring in France.

GABOTTO (L.). **La Tignuola della Patata.** [The Potato Moth.]—*Riv. Agric., Parma*, xxv, no. 32, 8th August 1919, pp. 304–305.

The potato moth, *Phthorimaea operculella*, Zell., has appeared in the Province of Palermo, Sicily, probably owing to the removal of import restrictions. This article of a popular character gives an account of the pest and of the methods of combating it, stress being laid on the danger of delay.

PETTIT (R. H.). **New Pests which have established themselves in the United States and for which we should be on the lookout.**—*Qrtrly. Bull. Michigan Agric. Expt. Sta., East Lansing*, i, no. 3, February 1919, p. 109. [Received 11th August, 1919.]

Attention is drawn to the importation into the United States of the eelworm, *Tylenchus tritici*, and the European corn borer, *Pyrausta nubilalis*, which have so far not been reported from Michigan, where however their appearance should be carefully looked for and immediately reported.

PETTIT (R. H.). **Periodical Cicada.**—*Qrtrly. Bull. Michigan Agric. Expt. Sta., East Lansing*, i, no. 4, May 1919, pp. 167–168.

The 17-year locust [*Tibicen septemdecim*], which has been predicted to appear in May and June 1919 [see this *Review*, Ser. A, vii, p. 381], is not expected to be seen in any new localities of Michigan, as its numbers have decreased at each appearance, in view of which fact the swarms for that State should be smaller than ever.

Report of Committee on uniform Rules and Regulations to govern Certification of Seed Potatoes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 6, June 1919, pp. 304–307. [Received 11th August 1919.]

It is notified that the presence of the eelworm, *Heterodera radicicola*, Greef., and the potato tuber moth, *Phthorimaea operculella*, Z., as well as of certain specified fungus diseases, will prevent certification of seed potatoes in California.

MASKEW (F.). **Report for the Month of April 1919.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 6. June 1919, pp. 309–311.

Insect pests intercepted during April 1919 included:—From Borneo: *Araecerus fasciculatus*, Cryptophagid beetles, *Lasioderma serricorne* and Lepidopterous larvae in nutmeg and various spices. From Central America: *Saissetia oleae*, *Aspidiotus lataniae* and *Chrysomphalus dictyospermi* on assorted plants; *C. scutiformis* and *Aspidiotus cyanophylli* on bananas; *Camponotus maculatus* and *Prenolepis* sp. on tree fern; *Pseudococcus virgatus* and *Parlatoria proteus* var. *crotonis* on croton; *Pseudococcus* sp. and *Aspidiotus* sp. on bananas. From Chile: *Phthorimaea operculella* in potatoes. From Connecticut: *Pseudococcus citri* on *Gardenia*. From Florida: *Lepidosaphes beckii* and *Phomopsis citri* on grapefruit. From Hawaii: *Hemichionaspis minor*, *Ripersia palmarum* and *Chrysomphalus aonidum* on coconuts; *Lecanium* sp. on a pot-plant; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Coccus longulus* on betel leaves; *Aspidiotus lataniae* and *Phenacaspis eugeniae* on mangos; *Lepidosaphes beckii*, *Pseudococcus citri* and ants on croton cuttings; weevils in seed-pods. From Japan: *Xyleborus* sp., *Eulecanium* sp. and cicada eggs on *Wistaria*; Otiorrhynchid weevils and ants in packing of nursery stock; *Pseudococcus* sp. on cedars; Aphids and *Cicada* eggs on persimmons; an Aegeriid borer in *Camellia japonica*. From Mexico: an undetermined weevil in sweet potatoes; *Heliothis* (*Chloridea*) *obsoleta* in tomatoes and *Chrysomphalus aurantii* on lemons. From Nevada: *Heterodera radicicola* on potatoes. From Pennsylvania: *Aphis* sp. on rose plants. From the Philippines: *Pseudococcus virgatus* on croton; *Pseudococcus crotonis*, *Parlatoria pseudaspidiotus* and *Pseudaonidia curculiginis* on orchids. From Tonga: *Ripersia palmarum* on coconut palm. From Washington: *Lepidosaphes ulmi* on apples.

Ramsay (A. A.). **The Mixing of Sprays.**—*Agric. Gaz. N.S.W., Sydney*, xxx, no. 6, June 1919, pp. 428–429.

Owing to the efficacy of combined insecticides and fungicides becoming more and more established, a diagram and table of compatible and non-compatible mixtures are given to assist the fruit-grower in mixing such sprays.

Terry (H. B.) & Schlupp (W. F.). **Tests of Lead Arsenate. Effectiveness of different Brands in controlling Codling Moth—A Progress Report.**—Reprint from *S. African Fruit Grower, Cape Town*, May 1919, 8 pp. [Received 13th August 1919.]

Tables are given showing the comparative efficacy against *Cydia pomonella* of the different brands of lead arsenate tested in 1917–18 and 1918–19 in areas of summer rainfall in South Africa.

The conclusion arrived at is that no one of the proprietary brands tested is markedly inferior to the others. Zinc arsenite also gave good results, but caused serious scorching of the fruit and foliage.

Chittenden (F. H.). **The Rice Moth.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. 783, 14th July 1919, 15 pp., 5 plates, 2 figs.

Corcyra cephalonica, Staint., has been known in the United States since 1911, but was not definitely identified until 1916. It causes serious damage to stored rice and all forms of cocoa and chocolate, whether sweetened or not. It also breeds in ships' biscuits and sesame seeds. Its habit of feeding on cacao beans is probably an acquired one.

All stages of the moth are described. Little is known of its life-history, in which it seems greatly to resemble the Indian meal moth, *Plodia interpunctella*, Hbn., and the fig moth, *Ephestia cautella*, Wlk. It has been found associated with *Silvanus surinamensis*, L. (saw-toothed grain beetle), *Tribolium castaneum*, Hbst. (*ferrugineum*, F.) (rust-red flour beetle), *Rhizopertha dominica*, F. (lesser grain borer), *Lophocateres pusillus*, Oliv. (Siamese grain beetle) and *Calandra oryzae*, L. (rice weevil).

The moths disappear during the cold weather, but seem to breed continuously at room temperature, although under laboratory conditions only two generations could be obtained in a single rearing jar. The insect requires a very short time for development, which varies according to climatic conditions. The cycle in the summer from egg to egg occupies about 28 to 42 days.

The remedial measures advocated are thorough cleaning and fumigation of all infested store rooms, sacks etc. by means of hydrocyanic acid gas, sulphur dioxide, carbon bisulphide, or by heat, the temperature required being from 120°–130°F. Rice and cacao beans are however damaged by exposure to the latter temperature for more than an hour.

Culver (J. J.). **A Study of *Compsilura concinnata*, an imported Tachinid Parasite of the Gipsy Moth and the Brown-tail Moth.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. 766, 10th July 1919, 27 pp., 1 plate, 1 map, 10 figs.

The Tachinid fly, *Compsilura concinnata*, Meig., was imported into the United States in 1906 from various European countries as

a parasite of the gipsy moth [*Porthetria dispar*] and the brown-tail moth [*Nygmia phaeorrhoea*], in the control of which it has now become one of the chief factors. The history of importation and colonisation of this parasite, as well as the method of handling and life-history under laboratory conditions are reviewed. *C. concinnata* has a very wide distribution in Europe and attacks 58 different species of Lepidoptera, a list of which is given. In America, where this parasite is comparatively new, the number of hosts has increased to 33. Reproduction in the laboratory was studied on *Callosamia promethea*, *Bombyx mori*, *Hemerocampa leucostigma* and *Pieris* (*Pontia*) *rapae*. Under laboratory conditions temperature exercises very little effect on the larvae, of which each female is capable of producing from 90 to 100, but the length of the adult stage varies greatly according to the temperature and method of handling. The mode of larviposition and subsequent development is discussed [see this *Review*, Ser. A, ii, p. 136]. All attempts to prove parthenogenesis in this parasite have failed. The extreme dates of collection of adults of this insect recorded in the field are 1st May and 29th October, those for puparia are 16th June and 30th September. The life-cycle occupies about 28–30 days, thus allowing the completion of 3 full generations during the season. Full details as to hibernation have not yet been worked out, but it is definitely recorded as taking place in *Papilio polyxenes*, F., *Diacrisia virginica*, F., *Deilephila galii*, Rott., *Deidamia inscriptum*, Harr., *Callosamia promethea*, Drury, and an unidentified Geometrid from which larvae of *C. concinnata* emerged for pupation in the spring. A single case of hibernation in *Pieris rapae* is recorded. Attempts to carry the parasite through the winter in the adult and pupal stages were not successful. Secondary parasites are known to attack the larvae and puparia of *C. concinnata*, but only when these are found above-ground. Supernumerary parasitism has also been noticed in *Nygmia phaeorrhoea*, from larvae of which examples of *C. concinnata* have been observed to emerge after the Hymenopterous parasite, *Meteorus versicolor*, Vier., had already done so.

Since the establishment of this parasite in the United States, *Hemerocampa leucostigma*, which was formerly a serious pest in New England, has practically disappeared; the Saturniid, *Callosamia promethea*, has become rare; *Pieris rapae*, though still a serious pest, has been materially reduced in numbers in some areas; the celery caterpillar, *Papilio polyxenes*, is less common; and the fall webworm, *Hyphantria cunea*, which was abundant in Eastern Massachusetts in 1910, is now scarcely noticeable. Though it is not claimed that this parasite is the sole cause of this reduction, its value in this respect has been considerable, apart from its beneficial effect on the outbreaks of gipsy and brown-tail moths.

Clemens (W. A.). **The Pine Bark Beetle (*Ips pini*, Say).**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. no. 383, October 1916, pp. 385–398, 2 plates, 4 figs. [Received 15th August 1919.]

All stages of *Ips pini*, Say, are described and the history and synonomy are reviewed. The distribution of this bark-beetle

includes twelve American States and two provinces of Canada. It probably attacks all species of pine in the Canadian and transitional zones, and also black spruce, Norway spruce, *Abies menziesii* and larch. Normally only dying or recently dead trees are attacked. The beetles have never been seen in flight or leaving a tree, but are probably attracted by the resinous odour of injured trees. Infestation may be very severe, 125 to 150 beetles having been found in a white pine log 7 feet long and about 4 inches in diameter. The upper part of the tree, where the bark is not too thick, or the larger limbs are usually selected for attack. The entrance hole is perfectly round and is usually made by the male closely followed by a female; when the sap-wood is reached a chamber is excavated between it and the outer bark, where pairing takes place.

From this chamber the female makes a longitudinal, primary gallery from 4 to 6 inches long. The egg-laying period extends from 25 to 35 days, and at a temperature of 69° F. the eggs take about 5 days to hatch. The larvae on emerging burrow into the cambium at right angles to the primary gallery. In cases of severe infestation, the larval galleries form a mass of interwinding mines. The pupal period lasts about 5 days. The adult beetle remains in the pupal chamber 4 or 5 days and then works in the cambium some time before emerging. At Ithaca two generations have been recorded; under favourable conditions a third is possible. The beetles of the late brood gradually become dormant as winter sets in and remain in the bark.

Wet seasons are detrimental to the development of the larvae and cause the beetle to be attacked in all stages by fungi. Predaceous enemies include the Clerid beetles, *Thanasimus dubius*, F., and *Enoclerus quadriguttatus*, Oliv., a Histerid, *Cylistix cylindrica*, Payk., the Staphylinids, *Xantholinus cephalus*, Say, *Quedius laevigatus*, Gyll., and *Homolota* sp., a Tenebrionid, *Hypophloeus parallelus*, Melsh., and probably also the Clerids, *Trichodes simulator* and *Clerus quadriguttatus*, Oliv. The following species have been taken in burrows, but may only be associates: the Histerid, *Platysoma coarctatum*, Lec., the Curculionids, *Dryophthorus corticalis*, Say, and *Cossonus* sp., the Cucujid, *Brontes dubius*, F., the Eucnemid, *Deltometopus amoenicornis*, Say, the Staphylinid, *Anthophagus* (*Geodromicus*) *strictus*, Fair., and an Anthocorid bug, *Dufouriellus ater*, Dufour. Mites and Nematodes have been found on the beetles, but the effect of their presence is not known. Black carpenter ants readily devour the beetles. Parasites include: Hymenoptera, *Roptrocerus eccoptogaster*, Ratz., *Spathius* sp., *Microbracon* sp. and a Chalcid; Diptera, an Agromyzid and *Phyllomyza* sp.

Removal of the bark will cause the death of all pupae and larvae, and if done carefully, will destroy a great number of adults and thus lessen the severity of future attacks. The attacks may also be prevented by placing the newly felled logs in water. The following beetles are often found in the part of the tree infested by *Ips pini*: *Monochamus* (*Monohammus*) *scutellatus*, Say, *Rhagium lineatum*, Oliv., *Pytho americanus*, Kirby, *Ips longidens*, Swaine, *Pityogenes* sp., and a Buprestid. In other parts of the tree the following may be found in addition: *Ips caelatus*, Eich., *I. calligraphus*, Germ., *Gnathotrichus materiarius*, Fitch, *Hylastes* (*Hylurgops*) *pinifex*, Fitch, and *Monochamus* (*Monohammus*) *confusor*, Kirby.

KITZEMA BOS (J.). **Bestrijding van de Boonenbladluis.** [Measures against the Bean Aphis.]—*Tijdschr. Plantenziekten, Wageningen,* xxv, no. 4, July 1919, pp. 129–144.

The common bean aphis, *Aphis rumicis*, L., infests a large number of shrubs and woody plants, of which a list is given. It has been recorded under various synonyms, including *Aphis papaveris*, F., *A. atriplicis*, F., *A. genistae*, Scop., and *A. euonymi*, F. Theoretically, the fifth generation of descendants of one female should number 3,276,800 individuals, and the importance of early measures is therefore apparent. Though there are many methods of destroying this Aphid, they are usually difficult to apply in practice. A preventive recommended by Dr. Feldt of Koenigsberg is based on the fact that a field of beans is first attacked at the edges, the insects subsequently spreading to the centre, when it is too late to do anything except to plough up the field. Such infestation, which occurs in May or June, starts from the woody plants on which the eggs have remained during the winter. The first signs of the pest in bean fields are noticed at the side removed from the prevalent winds. The plants should either be removed and burnt or sprayed with a spirit-soap solution. Spraying must be repeated if all the Aphids are not killed by the first application. Wherever possible beans should be planted in exposed situations and the rows should be arranged in the direction of the prevalent wind. Early sowing is desirable, and varieties should be chosen that soon form pods low down on the stalk. The seed should be soaked before planting to promote germination. Feldt states that when the rows run from east to west the plants are 50–100 per cent. taller than those in rows running from north to south, and as there is more shadow among the tall plants less fertilisation by insects takes place. Tall plants also interfere with the free passage of wind, so that Aphid injury is more probable. A space of about 2 feet should be allowed between the rows, but the plants can be close together in a row. Feldt also states that garden peas growing in a field of parsley were not attacked by Aphids, whereas a few yards away a field containing peas only was very heavily infested. Parsley, summer root crops and potatoes may be planted for this purpose, and a border of potatoes or tomatoes along the edges of a field of beans will protect the crop. The author remarks in this connection that in the Ukraine hemp planted among other crops is found to drive away many insect pests [see this *Review*, Ser. A, i, pp. 68, 191].

SCHOEVERS (T. A. C.). **Het Spint.** [Mite Injury.]—*Tijdschr. Plantenziekten, Wageningen,* xxv, no. 4, July 1919, pp. 145–155.

During the dry weather in June 1919 mite injury, due to *Tetranychus* spp., was very much in evidence at Wageningen. Descriptions of the injury and of the life-history of these mites are given. Some injury was also caused by mites of the genus *Bryobia*. Spraying with a 6–8 per cent. solution of carbolineum is recommended. Dusting with sulphur or the use of a sulphur-soap solution also give good results, and a 0·4 per cent. solution of liver of sulphur was found to be excellent. Sulphur should not be used on gooseberry bushes as it causes defoliation. A powerful stream of cold water will wash away the mites, and heavy showers of rain cause a reduction of infestation for this reason. A species of *Scymnus* is predaceous on these mites.

ONRUST (K.). **Ritnaalden en Boonen.** [Wireworms and Beans.]—*Tijdschr. Plantenziekten, Wageningen,* xxv, no. 4, July 1919, Bijblad pp. 17–19.

Serious injury to beans by wireworms was checked by placing slices of potato in the ground as traps. Skewers stuck through the slices made them easy to find. A useful preventive measure consists in damping the seed with petroleum before planting.

MARCHAL (P.). **Le Cycle évolutif du Puceron lanigère du Pommier** (*Eriosoma lanigerum*, **Hausmann**).—*C.R. hebdom. Acad. Sci., Paris,* clxix, no. 5, 4th August 1919, pp. 211–216.

The life-history of *Eriosoma lanigerum,* Hausm., as recorded in North America, is reviewed and compared with results obtained in France where this Aphid seems to have altered its habits since its importation about 100 years ago. In France the entire life-cycle is spent on the apple tree, propagation being maintained by means of the parthenogenetic reproduction of the hibernating forms. All attempts to induce the insect to return to its American food-plant, *Ulmus americana,* have proved unsuccessful. This is probably accounted for by the scarcity and occasional total absence of this food-plant in France, resulting in such changes in the plasma of the insect as to make its maintenance on *U. americana* impossible. An allied species, here described as *Eriosoma ulmosedens,* sp. n., does exist in France, on elm trees, but is morphologically and biologically distinct from *E. lanigerum.* This species lives in the spring in colonies on *Ulmus campestris* only, never on *U. americana,* and does not require migration to another plant to complete its life-cycle. The winged forms appear in the deformed buds of the elm in the summer and produce a mixed generation, composed both of sexual and asexual individuals, as in the case of *E. lanigerum.*

VAYSSIÈRE (P.). **Quelques Procédés de Destruction des Acridiens et leur Application.**—*C.R. hebdom. Acad. Sci., Paris,* clxix, no. 5, 4th August 1919, pp. 245–248.

Owing to recent ravages by the locusts, *Dociostaurus maroccanus, Calliptamus italicus* and *Schistocerca tatarica,* official missions were organised to conduct experiments with a view to controlling these pests of agriculture. The work was carried out in Morocco and the South-East of France and various methods were tried, of which full details are given.

The conclusions arrived at are that the best means of preventing invasion is to use flamethrowers over the whole infested area the moment the young hoppers are formed, provided there is no danger of fire. Alternative methods are the use of a spray consisting of a solution of 50 per cent. chlorpicrin and the use of arsenical poison-baits in places where animals are not likely to graze.

It is suggested that systematic scientific control measures on these lines should be undertaken; for this purpose a Committee should be organised by the various countries likely to be most interested, similar to the already existing South African Central Locust Bureau or the Defensa Agrícola of Montevideo.

GIBSON (A.). **The Greenhouse Leaf-Tyer** (*Phlyctaenia ferrugalis*, **Hbn.**).—*Agric. Gaz. Canada, Ottawa*, vi, no. 7, July 1919, pp. 626-629, 2 figs.

The Pyralid moth, *Phlyctaenia ferrugalis*, Hbn., of which all stages are described, was imported from the United States into Canada, where it has recently increased and caused much damage in greenhouses. It feeds on nearly all soft-leaved greenhouse plants and also on celery, tobacco, cabbage, sugar-beet, spinach, nasturtium, begonia and carnations in the field. The eggs are laid singly or in a mass on the under-side of the leaves. They hatch in about 14 days. As the generations overlap, larvae of all stages may be found at various seasons. All five instars of the larva feed on the leaves; sometimes two leaves are spun together by silken threads, the larvae then feeding on the under-side of the upper leaf. Pupation occurs in a folded-over portion of the leaf and lasts from 17 to 20 days. The moths rest during the day-time on the under-side of the leaves or in sheltered places in the greenhouse, and become active at night. The life-cycle from egg to the emergence of the moth occupies about 70 to 75 days in the winter. Under greenhouse conditions 3 or 4 generations may occur from September to May.

The natural enemies recorded from the United States include a Braconid, *Apanteles glomeratus*, L., an Ichneumonid, *Synetaeris* sp., and a Tachinid, *Phorocera parva*, Big. No parasites have yet been reared in Canada.

The following spray is advocated as a remedial measure: 1 oz. by weight of soluble sulphur, 1 fluid oz. of Black-leaf 40 and 6 gals. of water. This mixture applied three times at intervals of one week has proved successful, but care should be taken to spray the plants well from below at the first appearance of the pest.

RUSSELL (E. J.). **The Work of the Rothamsted Experimental Station from 1914 to 1919. Control of Soil Organisms and Pests.**—*Jl. Bd. Agric., London*, xxvi, no. 5, August 1919, pp. 504-506.

Owing to the importance of wireworms in view of their destructiveness to crops much attention has been paid to all possible means of control, including the effect of poisons applied to the soil. Ammonia has proved distinctly harmful to wireworms, and attention is called to the fact that it may be produced by the application of liquid manure or by folding sheep on the land. Other effective poisons tried were chlorphenol, which is about four times as toxic as phenol, and di-chlorcresol, which is about five times as effective as cresol.

RAMAKRISHNA AYYAR (T. V.). **Some Foreign Insect Pests which we do not want in India.**—*Agric. Jl. India, Calcutta*, xiv, no. 3, 1919, pp. 500-511, 3 plates.

In view of the recent Pests Act passed in India as a protection against the introduction of insect pests from other countries, a list is given of the most dangerous insects not yet found in India, as well as their most likely mode of entry into the country.

POWELL (T.). **Black Fly of Citrus trees.**—*Jl. Jamaica Agric. Soc., Kingston*, xxiii, no. 1, January 1919, pp. 16–17. [Received 26th August 1919.]

In addition to ants a brown fungus has been noticed destroying the eggs of the black fly [*Aleurocanthus woglumi*] on *Citrus*. It has apparently greatly reduced the numbers of this Aleurodid, and will spread naturally, as the spores are carried by the wind, thus proving a valuable factor in control. Artificial transportation of the fungus has so far been unsuccessful.

Banana Borer.—*Jl. Jamaica Agric. Soc., Kingston*, xxiii, no. 4, April 1919, p. 137. [Received 26th August 1919.]

The attention of growers is called to the spread of the banana borer [*Cosmopolites sordidus*] to localities previously unaffected. Owing to the favourable conditions which deserted plantations offer this pest, it is suggested that they should be sown with some hardy crop such as beans or peas. Additional care should be taken in the selection of banana plants when setting out the fields and all bulbs should be soaked in pure water for 24 hours. Traps should be set in already infested fields.

HOOD (J. D.). **New Genera and Species of Australian Thysanoptera.**—*Memoirs of Queensland Mus., Brisbane*, vi, 19th December 1918, pp. 121–150. [Received 26th August 1919.]

Descriptions of 24 new species of thrips from Australia are given, but no mention is made of any specific food-plants. The following new genera are erected and described: *Pterothrips, Phibalothrips, Euoplothrips* and *Phaulothrips*. Keys are also given to the Australian species of *Haplothrips, Liothrips* and *Cryptothrips*.

BRIDWELL (J. C.). **Some additional Notes on Bruchidae and their Parasites in the Hawaiian Islands.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 15–20.

In connection with a previous paper [see this *Review*, Ser. A, vi, p. 352] the following notes are of interest: In addition to the moths, *Cryptophlebia illepida* and *Myelois ceratomiae*, and the Bruchid, *Pachymerus (Caryoborus) gonagra*, pods of *Acacia farnesiana* have been found to contain *Bruchus sallaei*, Sharp, which greatly resembles *B. prosopis*, Lec. *A. farnesiana* is an imported shrub that has become a troublesome weed, and these insects are therefore beneficial in this respect. In Texas *B. sallaei* has been recorded as also breeding in *Acacia amentacea* and *Gleditsia triacanthos*. The eggs are laid in groups of 2 to 5 on the pods and seeds. The larvae each feed on one seed and enter it for pupation. Adults have fed and oviposited in confinement on pods of *Prosopis juliflora*. The eggs are parasitised by a Chalcid, *Uscana semifumipennis*.

The Dolichos weevil recorded in the previous report [*loc. cit.*] has now been identified as *B. phaseoli*, Gyll., which also occurs in Brazil, France and Italy.

B. pruininus, Horn, has been bred experimentally from the following additional food-plants: *Cassia siamea*, *Samanea saman* (monkey pod) not previously known to be attacked by Bruchids, *Acacia decurrens*, *Sesbania coccinea* and *Cassia grandis*.

B. quadrimaculatus, so far only known as a serious pest of pigeon peas and cowpeas in storage, is now reported on the latter in the field. It is parasitised, as is also *Calandra oryzae*, by *Chaetospila elegans*, Westw., but this parasite is practically of no use in controlling these pests.

Pachymerus gonagra was successful in completing its growth in a pod of *Cassia nodosa* in February 1918, by proceeding from one withered seed to another. Its apparent low parasitisation in certain districts by *Uscana semifumipennis*, Gir., is probably accounted for by the presence of only two food-plants, *Acacia farnesiana* and *Prosopis juliflora*, of which the seeds only ripen in particular seasons so that the insects do not breed continuously through the year thus limiting the opportunity of the parasites for multiplication. The two-spotted bean weevil has been identified as *Spermophagus pectoralis*, Sharp.

Bridwell (J. C.). **Some Notes on Hawaiian and other Bethylidaè (Hymenoptera) with Descriptions of New Species.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 21–38.

The species dealt with include *Perisierola emigrata*, Rohw., hitherto only known as a predator upon the pink bollworm (*Pectinophora gossypiella*). It was found in May attacking the larvae of *Cryptophlebia illepida* and *Myelois ceratoniae* feeding on *Acacia farnesiana*. In confinement it will also attack *Pyroderces rileyi*, *Ephestia elutella*, *Crocidosema lantanae*, *Tortrix* (*Archips*) *postvittana*, and other moths, as well as the grubs of the Anthribid, *Araecerus fasciculatus*, and the Bruchid, *Pachymerus gonagra*. When the host has succumbed to attack, *P. emigrata* feeds on its juices at the point of the sting and commences oviposition on its surface about one or two hours later. The number of eggs deposited varies according to the size of the larval host.

The endemic Hawaiian species of *Sclerodermus* are also discussed. Among these *S. immigrans*, Bridwell, and *S. manoa*, sp. n., were found experimentally to attack Bruchid larvae.

Fullaway (D. T.). **Description of *Paranagrus osborni*, sp. n. (Hymenoptera, Mymaridae).** — *Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, p. 53.

Paranagrus osborni, sp. n., is described from the Philippine Islands where it was bred from eggs of *Peregrinus maidis*.

Williams (F. X.). ***Epyris extraneus*, Bridwell (Bethylidae), a Fossorial Wasp that preys on the Larva of the Tenebrionid Beetle, *Gonocephalum seriatum* (Boisduval).**—*Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 55–63, 7 figs.

Epyris extraneus may be found in Hawaii at all seasons of the year. It preys under natural conditions on the larva of *Gonocephalum seriatum*, which may be found under cane trash and other rubbish, on which

it probably feeds, as it does not appear to be injurious in the cane fields. The larval stage of this wasp requires about $4\frac{1}{2}$ days, and the pupal stage during August and September was about 23 days, making the life-cycle from egg to adult about one month.

WILLIAMS (F. X.). **Some Observations on the Leaf-hopper Wasp, *Nesomimesa hawaiiensis*, Perkins, at Pahala, Hawaii, Feb. 11-April 25, 1918.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 63-68, 3 figs.

The hunting and nesting habits of *Nesomimesa hawaiiensis*, Perk., are described. This wasp has not been found below an elevation of about 1,000 feet, but is met as high up as 3,500 feet. Its chief prey is the sugar-cane leaf-hopper, *Perkinsiella saccharicida*, Kirk., and it may prove very useful in controlling this pest, as one female may capture as many as 100 hoppers and cloudy weather, or even rain, does not apparently affect its activity.

WILLIAMS (F. X.). **Some Observations on Pipunculus Flies which parasitize the Cane Leaf-hopper, at Pahala, Hawaii, Feb. 11-April 25, 1918.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 68-71, 1 fig.

The habits of some Pipunculid flies, including *Pipunculus juvator*, Perk., *P. hawaiiensis*, Perk., and an undescribed species, are recorded. These flies have transferred their attention from native leaf-hoppers to the sugar-cane leaf-hopper [*Perkinsiella saccharicida*]. When the prey is secured, young or half-grown individuals being preferred, it is born up in to the air and an egg is deposited on it, after which the host is dropped, apparently unhurt. The egg and larval stage of the parasite extend over approximately 40 days. The mature grubs kill the already sluggish host as they emerge; after emergence they very soon pupate, this stage lasting from 28 to 34 days in February and March. The pupa may frequently be found at the base of, or on sugar-cane leaves.

BRIDWELL (J. C.). **Miscellaneous Notes on Hymenoptera with Descriptions of New Genera and Species.**—*Proc. Hawaiian Entom. Soc. Honolulu*, iv, no. 1, June 1919, pp. 109-165.

The large number of Hymenoptera here described include the Ichneumonid, *Amblyteles koebelei*, Swez., attacking cutworms, and the Braconid, *Microbracon pembertoni*, sp. n., bred from *Pectinophora gossypiella, Myelois ceratoniae* and *Cryptophlebia illepida*.

BRIDWELL (J. C.). **Descriptions of New Species of Hymenopterous Parasites of Muscoid Diptera with Notes on their Habits.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 166-179.

The new species described include: ICHNEUMONIDAE: *Atractodes muiri* from *Sarcophaga* sp. living in decaying fish in Japan; *A. mallyi* from *Sarcophaga* sp. in human excrement in South Africa.

BRACONIDAE: *Microbracon terryi* from *Tephrites crassipes* breeding in heads of *Bidens* in Hawaii, and doubtless an immigrant; *Opius lantanae* from the undetermined Agromyzid fly of lantana-seed in Hawaii; *Hedylus desideratus* from various species of *Dacus* and *Ceratitis* in Nigeria; both these species and *O. lantanae* may remain for a considerable time dormant during the larval stage; *H. clypeatus* from the fruit of an unknown vine containing fruit-fly larvae in Nigeria; *Alysia lusoriae* from *Musca lusoria* breeding in cow-dung near Cape Town; *Aphaereta sarcophagae* from an undetermined *Sarcophaga* breeding in human excrement near Cape Town.

CYNIPIDAE: *Bothrochacis stercoraria* from *Musca lusoria* and *Lasiopyrellia cyanea* near Cape Town.

In the case of all these parasites the egg is deposited in the larva and the adult emerges from the puparium of the host.

TIMBERLAKE (P. H.). **Observations on the Sources of Hawaiian Encyrtidae (Hymenoptera).** — *Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 183–196.

The endemic Encyrtid fauna of Hawaii is represented by five genera with about twenty to twenty-five species. In addition to these about eighteen genera have been introduced, probably from North America, Australia, Polynesia and Oriental regions. Their exact source is not known, as the majority have been unintentionally imported and probably gained entrance with their hosts. Their possible means of introduction and aids to their establishment are discussed, the species under review including: *Blepyrus mexicanus*, How., parasitic on *Pseudococcus virgatus*, Ckll.: *Tanaomastix abnormis*, Gir., on *Pseudococcus krauhniae*, Kuw., and *P. virgatus*; *Encyrtus infelix*, Emb., on *Saissetia hemisphaerica*, Targ.; *Aphycus alberti*, How., on *Coccus hesperidum*, L., and *C. longulus*, Dougl.; *Pseudococcobius terryi*, Full., on *Pseudococcus saccharifolii*, Green; and *Adelencyrtus odonaspidis*, Full., on *Odonaspis ruthae*, Kotinsky.

TIMBERLAKE (P. H.). **Descriptions of New Genera and Species of Hawaiian Encyrtidae (Hymenoptera).**—*Proc. Hawaiian Entom. Soc., Honolulu*, iv, no. 1, June 1919, pp. 197–231.

The new species described include: *Anagyrus nigricornis* from *Pseudococcus lounsburyi*, Brain, *P. montanus*, Ehrh., *P. gallicola*, Ehrh., *Ripersia palmarum*, Ehrh., and experimentally from *P. longispinus*, Targ.; *A. swezeyi* from *Trionymus insularis*, Ehrh.; *Xanthoencyrtus apterus* probably parasitic on *Trionymus insularis*; *X. fullawayi* from *Pseudococcus saccharifolii*, Green; *Pauridia peregrina*, gen. et sp. n., from *Pseudococcus krauhniae*, Kuw.; *Encyrtus barbatus* from *Saissetia hemisphaerica*, Targ., and *S. nigra*, Nietn.; *Quaylea aliena*, gen. et sp. n., from *Saissetia nigra*, *Asterolecanium pustulans*, Ckll., and *Coccus viridis*, Green, this species though parasitising various Coccids, being probably a secondary parasite; in *Asterolecanium* it probably attacks *Tomocera californica*, How., and in *Saissetia* and *Coccus* the attacked insect may be *Microterys kotinskyi*, Full., and other primary parasites; *Aphycomorpha araucariae*, gen. et sp. n., from *Eriococcus araucariae*, Mask.; *Anicetus annulatus* from *Eucalymnatus tessellatus*, Sign., and *Saissetia hemisphaerica*, Targ.

FULLAWAY (D. T.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu,* xvi, no. 6, June 1919, pp. 157–159.

Pests intercepted during May 1919 included: From Japan: A caterpillar found on leaves of *Cryptomeria*; a Dipterous maggot on leaves of palms; scale-insects; and the ants, *Monomorium pharaonis* and *Prenolepis longicornis*, in soil and packing; from San Francisco: Bruchids infesting carob beans; from Manila: Anthribid beetles in yams; from California: mealy bugs on dahlia bulbs.

HARUKAWA (C.) & YAGI (N.). **On the Life-History and Habits of a Peach Leaf-Miner,** *Ornix* **sp.**—*Berichte Ōhara Inst. landwirtschftl. Forschungen, Kuraschiki,* i, no. 3, 1918, pp. 325–333, 1 plate. [Received 21st August 1919.]

The leaf-miner of the peach dealt with in this paper belongs to the genus *Parornix* (*Ornix*) and may possibly become of economic importance under conditions favourable to it. Breeding experiments show that there are 4 complete and 1 partial generation in a year. The first covers about 50 days, the third about 26 and the second and fourth about 30 each. The winter generation is the longest, owing to the pupae hibernating and the adults emerging in the spring. The generations overlap, so that individuals of different stages of growth occur together. The adult, egg and larva are described. The adult is rather sluggish, and unless carried by a strong wind migration to another orchard is not probable.

The eggs are laid singly on the under-side of the leaf, mostly close to the mid-rib. The number of eggs per female varies; in one case 70 eggs were laid, and 58 in another. The egg-stage lasted from 3 days to about 2 weeks in the breeding experiments. The newly-hatched larva immediately begins mining the epidermis of the under-side of the leaf at the point where the egg is cemented to it. This blotch-mine cannot at first be detected from the upper leaf-surface. At the end of the third larval stage the blotch-mine becomes almost elliptical in outline and its upper side becomes slightly projected upwards, so that a cavity is formed between the lower epidermis and the roof of the mine. Near the middle of the fourth stage the larva leaves its original mine and builds a new completely closed cell within the leaf, in which it conceals itself and continues feeding. When full-grown the larva either spins a yellowish cocoon at one end of the mine or it leaves the mine, folds over the edge of the leaf and fastens the edge to the leaf-surface and builds its cocoon in the recess. The cocoons of the last brood are formed on leaves that later fall to the ground, or on curled strips of the bark.

The peach is the favourite food-plant, but several other Rosaceae are attacked, including the plum, cherry, Japanese flowering cherry, apple and apricot, especially the first two.

To combat this insect it is advisable to remove all fallen leaves and rubbish and to scrape the rough outer bark of the trees. A pyrethrum decoction spray is said to be effective against the adults.

HARUKAWA (C.) & YAGI (N.). **The Serpentine Leaf-Miner of the Peach, a species of *Lyonetia*.**—*Berichte Ōhara Inst. landwirtschftl, Forschungen, Kuraschiki*, i, no. 3, 1918, pp. 335–348, 1 plate. [Received 21st August 1919.]

One of the important peach pests in Japan is a leaf-miner first described by Sasaki in 1903, of which the complete life-history was worked out in 1909 by Kuwana and Takachiho, the name, *Lyonetia clerkella*, L., being used in their results published in 1911. The Japanese serpentine leaf-miner does not, however, seem to be the same species as that described by European authors, though it is very closely allied to it.

Observations on it made since the summer of 1915 are here recorded. This moth occurs in various provinces, but its presence in Hokkaido is doubtful, although an apple pest occurs there which is probably identical with *L. clerkella*. There appear to be 7 generations a year, the last probably being a partial one. The length of the life-cycle varies from 16 to 32 days according to the season. The length of the egg-stage is 2–8 days, of the larval 7–16, of the pupal 3–9, and of the adult 4–7. The egg, larva, pupa and adult are described. The moth rests on the under-surface of the leaf during the day, and its flight is so slow that it can be captured by hand. Oviposition takes place at night, the egg being laid in the leaf-tissue. The number of eggs varied from 37 to 132 in the experiments. The food-plants of the larva are the peach and sand-cherry, the former being preferred. It has not been observed on apple or cherry. The eggs are laid singly. The full-grown larva is 5–6 mm. in length and remains until mature in the mine, where it moults twice. On leaving the mine it begins to spin its cocoon. Though the egg is introduced into the leaf-tissue from the lower surface of the leaf it is laid just under the upper epidermis. The mine is serpentine in outline. The mature larva leaves the mine by cutting open the upper epidermis, and usually spins its cocoon on the under-side of the leaf. The structure of the cocoon and the method of spinning are as in *L. clerkella*. This miner hibernates in Japan in the adult stage, passing the winter in warm, protected places. A very brief description is given of four Chalcid parasites of the larva reared in August and September. A Braconid was reared from the pupae.

The paper concludes with a comparison of the characters, habits, food-plants, etc., of this species and of *L. clerkella*.

YAGI (N.). **Preliminary Note on the Life-Period of the Bulb Mite, *Rhizoglyphus echinopus*.** — *Berichte Ōhara Inst. landwirtschftl. Forschungen, Kuraschiki*, i, no. 3, 1918, pp. 349–360, 8 figs, 1 plate. [Received 21st August 1919.]

The present paper deals principally with the external morphology of each stage found during the summer of the bulb-mite, *Rhizoglyphus echinopus*. This mite moults twice, and the duration of one generation is about 10 days in August, 15 in July, and 20 in June. Temperature is the chief factor in this variation and has an important effect on the embryonic development. The experiments made seem to show that

at least 10 annual generations may occur. The number of eggs laid by one female varied from 9 to 59, each being dropped singly on the surface of the bulb. The larva is sluggish and bores in the tissue of bulbs or through the roots of the grape-vine. The first pupa, nymph and second pupa are found in depressions in injured tissue or between the scales of a bulb. The adults mate within 2–8 hours of reaching maturity and oviposition begins on the day of mating. The life of the female is about 2–4 weeks in summer while that of the male is shorter. In the root of the grape-vine *Phylloxera* larvae are found accompanying this and other mites. A *Fusarium* fungus has been found to infest *E. echinopus*.

A list of the recorded food-plants is given, including a variety of bulbs, potato, cereals and orchids, the grape-vine being the chief one in the green-houses of the Ohara Institute.

YAMAMOTO (R.). **On the Insecticidal Principle of** *Chrysanthemum cinerariifolium*, **Bocc. (Insect Powder). Part I.**—*Berichte Ohara Inst. landwirtschftl. Forschungen, Kuraschiki*, i, no. 3, 1918, pp. 389–398. [Received 21st August 1919.]

From the flowers of *Chrysanthemum cinerariifolium*, widely cultivated in Japan, the author has isolated a yellow, transparent neutral syrup which has the characteristic smell of insect powder. This substance, called pyrethron by the author, controls the development of bacteria in addition to possessing strong insecticidal properties. Its power is reduced by heating or exposure to air for a long period.

WEBSTER (R. L.). **The Strawberry Leaf-roller** (*Ancylis comptana*, **Fröhl.**).—*Iowa Agric. Expt. Sta., Ames*, Bull. no. 179, November 1918, pp. 233–256, 9 figs. [Received 28th August 1919.]

This account of *Ancylis comptana*, Fröhl., much of which has been previously noticed [see this *Review*, Ser. A, vi, p. 196] gives descriptions of the bionomics of this moth and of the damage caused by it. These observations were made in Iowa and a comparison is made of its appearance and abundance in other parts of the United States. *Ancylis conflexana*, Wlk., and *A. fragariae*, Walsh & Riley, are treated as synonyms.

The recorded natural enemies include the Hymenopterous parasites, *Iseropus alboricta*, Cress., *Cremastus cookii*, Weed, and *Glypta phaxopteridis*, Weed. The first of these was the only parasite determined of several found in the present investigation. The remedial measures advocated are the mowing over of the foliage and burning it immediately after the crop is off, and the use of arsenical sprays. The formula recommended is 3 lb. of lead arsenate paste to 50 U.S. gals. of water, or half this amount of powder.

A list of the European food-plants recorded for this species is given. In North America it is only known to attack blackberries and raspberries, besides strawberries.

SWENK (M. H.). **The Western Wheat-head Army-worm.**—*State Entomologist Nebraska, Lincoln*, Bull. no. 8, 12th October 1918, 3 pp., 1 fig. [Received 27th August 1919.]

Great damage was caused in 1918 in the United States to spring wheat, Durum wheat and to a lesser extent to oats by the ravages of *Meliana (Neleucania) albilinea limitata* (wheat-head army-worm). The injury was first noticed at the beginning of September, but had completely ceased by the end of the month, during which time the damage caused varied from 50 to 70 per cent. in some fields, and in one case 300 acres of spring-wheat were completely destroyed. The caterpillars eat the kernels, commencing at the bottom of the head and gradually working their way up, and not infrequently cut the head completely off. As a rule only standing grain is attacked, but wheat in stock is by no means immune, and in one case caterpillars were even found eating the grain in the bins after it had been threshed.

The moths are on the wing in May and lay their eggs in clusters of 25 to 150 on grasses and grains. The larvae hatch after 3 to 10 days, and become fully grown in about one month. About June or early July they enter the soil for pupation, which takes place in a loose cocoon of earth spun together with silk. The second generation of moths generally appears after about a month, although some individuals may not emerge until the following spring. The moths on the wing during August and early September oviposit between the sheath and stalk of grasses or grain immediately below the upper blades. These eggs give rise to the brood of caterpillars so injurious to cereals in September. When fully grown they drop to the ground and enter the soil as deep as six inches for pupation, in which state they hibernate until the following May. The parasites of this pest include several Tachinid flies and Hymenoptera.

The remedial measures advocated are the use of poison-baits to be spread across the line of march of the caterpillars, the following formula being recommended:—25 lb. of wheat-bran, 1 lb. of Paris green, the juice, pulp, and peel of six lemons or oranges ground finely and ½ U.S. gal. of molasses or syrup mixed with sufficient water to make a stiff dough. This bait may also be used in fields already infested, in which case it should be sown broadcast in the late afternoon or night. Care must be taken to keep all stock away from the bait. As most of the injury arises from caterpillars that have migrated from neighbouring grasslands, infestation of fields may be prevented by the use of furrows or ditches in which pits are dug at intervals. To prevent reinfestation in the following year the pupae should be destroyed by deep ploughing; when standing small grain is attacked, it should be cut as soon as possible and immediately threshed or stacked. Infestation in granaries may be dealt with by fumigation with carbon bisulphide.

AMOS (A.). **The Difficulties of growing Red Clover—Clover Sickness and other Causes of Failure.**—*Jl. R. Agric. Soc. England, London*, lxxix, 1918, pp. 68–88, 5 figs. [Received 29th August 1919.]

The disease caused by the eelworm, *Tylenchus devastatrix*, presents one of the chief difficulties in red clover cultivation. The plants may be attacked in any stage, but the pest is most fatal to seedlings. The

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dry conditions of spring and summer are not favourable to the spread of this eelworm, but under suitable moist conditions the eggs, deposited in the tissues of the plant or in the soil, hatch very rapidly. The damage caused to plants and the mode of infestation is similar to that of *T. tritici* [see this *Review*, Ser. A, vii, pp. 324, 380]. Experiments were made to ascertain the susceptibility of various plants, details of which are given and which also confirm the statement of Ritzema Bos that *T. devastatrix* does not readily change its food-plant [see this *Review*, Ser. A, v, p. 441 and vii, p. 356]. In view of this fact the remedial measure advocated is to starve out the eelworms by avoiding the planting of red clover or other susceptible crops for at least 8 to 10 years; the alternative crops suggested are sainfoin, lucerne, trefoil and white clover, either alone or mixed with Italian rye-grass.

WARBURTON (C.). **Annual Report for 1918 of the Zoologist.**—*Jl. R. Agric. Soc. England, London*, lxxix, 1918, pp. 258–263. [Received 29th August 1919.]

During 1918 many crops were seriously damaged by insect pests, including the wheat bulb-fly [*Hylemyia coarctata*], which was not quite so widely distributed as in previous years but caused severe damage in some places. The wetness of the season proved fatal to the mature insects, in consequence of which it is hoped that future attacks will be less serious. A flea-beetle, *Phyllotreta vittula*, much reduced the yield of barley crops by damaging the leaf-blades, and attention is also called to the recurrence of caterpillars of *Trachea* (*Hadena*) *basilinea* attacking the grain of wheat.

Charaeas graminis (antler moth) was very abundant and damaged pastures. Mangels suffered greatly from the mangel fly [*Pegomyia hyoscyami*] where they were planted alone, but escaped entirely when interplanted with swedes. This crop was also heavily infested by the black bean aphis [*Aphis rumicis*]. Turnips were attacked by the turnip-seed weevil [*Ceuthorrhynchus assimilis*] and gall weevil [*C. sulcicollis*], the latter being also reported on cabbages.

This crop suffered from the usual cabbage caterpillars as well as those of *Pionea forficalis*, against which, besides hand-picking, salt solution and "Belumnite" proved useful.

Peas and beans suffered from pests rather less than in previous years, except from the ravages of the bean aphis (*Aphis rumicis*). Wireworms and leather-jackets were extremely abundant; in certain fields examined in Shropshire the minimum number per acre was estimated respectively at 215,000 and 13,000, and the highest counts per acre were 510,000 and 220,000. Even in cold weather they were all found within $1\frac{1}{2}$ inches of the soil surface. Paring and burning the surface soil where possible and thorough rolling and consolidation of it after seeding greatly reduced the damage to the crop.

ROHWER (S. A.). U.S. Bur. Entom. **Descriptions of three Parasites of** *Agrilus angelicus* **(Hym.).**—*Proc. Entom. Soc., Washington, D.C.*, xxi, no. 1, January 1919, pp. 4–8, 1 fig. [Received 12th September 1919.]

The parasites of *Agrilus angelicus*, Horn, infesting *Quercus agrifolia*, here described are: *Ptinobius agrili*, *Dinotus agrili* and *Doryctes*

maculipennis, all from California. The last-named is also recorded as parasitic on a species of *Chramesus* mining in *Robinia neomexicana* and on a species of *Anthaxia* infesting redbud (*Celtis reniformis*). A key to the species of *Ptinobius* is given.

BAKER (A. C.). U.S. Bur. Entom. **The Identity of *Smynthurodes betae*, Westwood (Hom.).**—*Proc. Entom. Soc., Washington, D.C.*, xxi, no. 2, February 1919, pp. 36–38. [Received 12th September 1919.]

Smynthurodes betae, Westw., here described is distinct from the American beet Aphid, *Pemphigus betae*, Doan, but as the difference in the character of the antennae, on the strength of which it was separated from *Forda*, Heyd., is so small, it is suggested that it should be placed in that genus.

RITZEMA BOS (J.). **Verslag over Onderzoekingen, gedaan in-, en over Inlichtingen, gegeven van het Instituut voor Phytopathologie te Wageningen, in het Jaar 1915.** [Report on Researches made and Advice given during the Year 1915 by the Institute for Phytopathology at Wageningen.] — *Meded. Landbouwhoogeschool, Wageningen*, xvi, 1919, pp. 105–157. [Received 21st August 1919.]

Pests of grain included the Nematodes, *Tylenchus devastatrix* and *Heterodera schachtii*, on rye and oats respectively. *Oscinella* (*Oscinis*) *frit*, L., and *O. pusilla*, Meig., did much damage, especially to oats, which were also attacked—for the first time in Holland—by the mite, *Tarsonemus spirifex*. Sugar-beet and clover were also injured by *Tylenchus devastatrix*. In a series of spraying experiments against the widely-spread scale, *Eulecanium* (*Lecanium*) *corni*, Bch., the best, though limited, result was obtained with a 5 per cent. solution of carbolineum used in January. This insecticide, at a percentage of 3–8, proved efficient against the mite, *Bryobia ribis*, Thom., infesting gooseberry; for practical work a strength of 5 per cent. is advised. *Incurvaria* (*Lampronia*) *rubiella*, Bjerk., was successfully combated on raspberry bushes with carbolineum [see this *Review*, Ser. A, iv, p. 89]. Garden peas were again attacked by *Heterodera schachtii*. The larvae of a beetle, *Phaedon cochleariae*, injured cauliflowers, and maggots indistinguishable from those of *Phorbia* (*Chortophila*) *brassicae* attacked Brussels sprouts. *Heterodera radicicola* did serious damage to tomatoes.

Coleopterous pests of kitchen gardens included *Apion* sp., *Crioceris asparagi*, L., and *Gastroidea viridula*, DeG. The first-named was checked by spraying with 6–10 per cent. solutions of naphthaline soap, naphthol soap and benzol soap. *C. asparagi* was checked with a 3 per cent. solution of benzol soap, though the same strength of ordinary soft soap was equally effective, and for *G. viridula* a 2 per cent. solution of common soap proved sufficient.

Experiments were conducted with a view to ascertaining if heat could be safely used for killing *Tylenchus devastatrix* infesting narcissus bulbs, but no definite result was reached. Other experiments are

mentioned which warrant the hope that hot-air treatment may prove effective against this Nematode in these bulbs. Tulip bulbs infested with *Aphis tulipae*, Boy., were treated by fumigation for half an hour with carbon bisulphide at the rate of 500 c.c. per cubic metre of space. *Liothrips setinodis*, Reuter, infested the bulbs of *Lilium pardalinum* as in the preceding year; two hours' treatment with a 2 per cent. solution of naphthaline soap killed all individuals. Sprinkling the bulbs with naphthaline also gave good results.

Willows were attacked by beetles, especially *Phyllodecta vulgatissima*. In former years spraying with Paris green or lead arsenate gave very irregular results, and investigation has shown these to be due to the actual leaf-surface being protected from the insecticide by the hairs found on the under-side of the foliage of many species of willow. Spraying with these poisons is however useful in the case of willows with smooth leaves. Infestation on other willows may be checked by very early spring spraying of the twigs and young leaves, on which the beetles that have hibernated feed prior to ovipositing. Collection of these beetles may also be resorted to. The infestation with *Diprion* (*Lophyrus*) sp. of *Pinus cembra* that had been sprayed with carbolineum in winter showed that the cocoons of this sawfly are impenetrable to this insecticide; the larvae may be combated by spraying with Paris green during the summer.

The Chalcid parasite, *Monodontomerus dentipes*, Boh., was bred from cocoons of *Diprion* (*Lophyrus*) *pini*. The Ichneumonid, *Hemiteles bicolorinus*, was liberated in a forage store infested by meal moths and it is estimated that the pests were reduced by 80 per cent. in consequence. Larvae of the rose sawfly, *Emphytus cinctus*, that were hibernating in rose stems, were found to be parasitised by *Monoblastus neustriae*, Rtz., *Hemiteles castaneus*, Tasch., *Microcryptus erythrinus*, Grv., and *Cratocryptus* (*Cubocephalus*) *oviventris*, Grv. *Contarinia* (*Diplosis*) *pyrivora* was found to be parasitised by *Inostemma piricola*. Among the parasites bred in the laboratory were *Litus nigriceps*, sp. n., from a Homopteron; *Aspidiotiphagus schoeversi*, sp. n., from the scale, *Chionaspis aspidistrae*; and *Chiloneurus vanpoetereni*, Smits van Burgst, and a species of *Encyrtus* or *Eucomys*, from *Saissetia* (*Lecanium*) *hemisphaerica*.

A brief report by Smits van Burgst is appended regarding work at the entomological laboratory of the Institute of Phytopathology at Ginneken, which has a very rich collection of ICHNEUMONIDAE.

THEOBALD (F. V.) **Insects on the Sea Buckthorn.**—*The Entomologist, London*, lii, no. 675, August 1919, pp. 169–171, 1 fig.

In searching for *Rhopalosiphum hippophaës*, Koch, on sea buckthorn (*Hippophaë rhamnoides*) countless nymphs of *Psylla hippophaës*, Först., were found in company with it. The brown-tail moth, *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*) was also found in very large numbers, and had completely defoliated one patch of this plant. Larvae have been collected to ascertain the presence of any parasites. The Tachinid fly, *Thelymorpha vertiginosa*, Fln., is the only parasite of this moth so far recorded. Other insects collected included the gold-tail moth, *Arctornis chrysorrhoea* (*Porthesia similis*).

SPEARE (A. T.). **The Fungus Parasite of the Periodical Cicada.**—*Science, Lancaster, Pa.* l, no. 1238, 1st August 1919, pp. 116–117.

The fungus, *Massospora cicadina*, is reported as having been very prevalent during the recent reappearance of brood *x* of *Cicada septemdecim*.

LIND (J.), ROSTRUP (Sofie) & KØLPIN RAVN (F). **Oversigt over Landbrugsplanternes Sygdomme i 1915.** [Report on Agricultural Pests in Denmark in 1915.]—105 *Beretning fra Statens Forsøgsvirksomhed i Plantekultur, Copenhagen*, 1916, pp. 397–423.

Among pests of cereals, *Heterodera schachtii* var. *avenae* occurred as usual in many localities. The injury was most severe in places where oats, or oats mixed with other plants, had been cultivated previously, but, on the other hand, the non-cultivation of oats even for a period of many years does not ensure protection against this eelworm. Besides oats, winter barley was injured in one locality and spring barley and wheat in another. *Hylemyia coarctata*, Fln., was considerably less numerous than in previous years. A flea-beetle, *Phyllotreta vittula*, Redt., occurred in many localities in great numbers, especially on spring barley in April and May.

Oscinella (*Oscinis*) *frit*, L., was less troublesome than in 1914, owing to cold weather in the spring. The barley-fly, *Chlorops taeniopus*, Meig. (*pumilionis*, Bierk.), was very rare. The larvae of *Cephus pygmaeus*, L., occurred in unusually large numbers in barley in July, the attack being remarkable owing to its apparent occurrence only in certain varieties. The caterpillars of *Trachea* (*Hadena*) *secalis*, Schiff., occurred as usual in rye in May and June, and those of *T.* (*H.*) *basilinea* in August and September. A severe attack of *Luperina* (*Apamea*) *testacea*, Hb., occurred on oats sown after timothy and meadow-fescue. The Cecidomyids, *Contarinia tritici*, Kirb., and *Sitodiplosis mosellana*, Gehin, (*C. aurantiaca*, Wagn.) were present only in small numbers. The Aphids, *Siphonaphis padi*, L., and *Macrosiphum granarium*, Kirb. (*cereale*, Kalt.) occurred in June and July on rye and wheat and especially oats. *Limothrips denticornis*, Hal., *L.* (*Thrips*) *cerealium*, Hal., *Haplothrips* (*Anthothrips*) *aculeatus*, Fln., and a mite, *Tarsonemus spirifex*, March., occurred in several localities.

Sitones lineatus, L., damaged peas, especially where mixed crops were cultivated, and attacks of *Cydia* (*Grapholitha*) sp. were observed in some localities in July and August, and of *Aphis rumicis*, L. (*papaveris*, F.) on horsebeans in July. Beets and sugar-beets were attacked by *Heterodera schachtii*, Sch., *Gortyna* (*Hydroecia*) *micacea* Esp., *Pegomyia hyoscyami*, Pz., *Sminthurus viridis*, L., *Forficula auricularia*, L., and *Aphis rumicis*. The larvae of *Blitophaga* (*Silpha*) *opaca*, L., were exceptionally numerous in many parts of the country, the attack occurring chiefly in June.

Pests of cabbages, swedes, turnips, etc., included *Phorbia* (*Chortophila*) *brassicae*, Bch.; *Ceuthorrhynchus quadridens*, Pz.; *Phyllotreta nemorum*, L., which injured swedes throughout the summer, especially late-sown plants; *Plutella maculipennis*, Curt.; *Pieris rapae*, L.; *Eurydema oleraceum*, L., in July and August on swedes, turnips and curly kale, the attack being chiefly confined to fields in sheltered places; the locusts, *Stauroderus* (*Stenobothrus*) *bicolor*, Charp., and

Omocestus ventralis, Zett. (*S. rufipes*, Fisch.), which occurred in unusually large numbers and completely devoured the outer rows in turnip fields adjacent to ditches or road-sides; *Brevicoryne (Aphis) brassicae*, L., seriously infesting swedes, turnips and cabbage cultivated for seed at the end of June; *Meligethes aeneus*, F., in great numbers in seed-turnip fields; and the larvae of *Psylliodes chrysocephala*, L., causing some injury in April and May.

Carrots were attacked by *Trioza viridula*, Zett., and *Psila rosae*, F., and potatoes by *Calocoris norvegicus*, Gmel., which did considerable injury in June and July.

Pests of lucerne and clover included *Hypera (Phytonomus) nigrirostris*, F., and *Eurydema oleraceum*, L. *Tylenchus devastratrix*, Kühn, as usual did great damage in many places, chiefly in fields where clover had been cultivated after a short interval in the rotation; but even in fields where clover had not been cultivated for 12 years, the rotation being fallow, wheat, swedes, barley, severe attacks occurred on red clover.

The larvae of *Luperina (Apamea) testacea*, Hb., did great damage to cocksfoot grass, timothy and meadow fescue cultivated for seed in many localities. The moth emerges from July to September and oviposits at the base of tufts of grass. The larvae hatch in the autumn and enter the shoots; they continue feeding throughout the winter until June or July of the following year. No effective measures of control have yet been found, even deep ploughing of the grass failing to kill the larvae.

Wireworms (*Agriotes lineatus*, L.) in May and June damaged spring barley after swedes, and some attacks on wheat were so severe that it was necessary to replough the fields. *Tipula paludosa*, Meig., in some localities severely injured spring grain.

LIND (J.), ROSTRUP (Sofie) & KØLPIN RAVN (F.) **Oversigt over Landbrugsplanternes Sygdomme i 1916.** [Report on Agricultural Pests in Denmark in 1916].—114 *Beretning fra Statens Forsøgsvirksomhed i Plantekultur, Copenhagen*, 1917, pp. 229–254.

The bulk of the pests recorded in this report are the same as those mentioned in the previous one [see preceding paper].

Bibio hortulanus, L. is recorded for the first time as a pest in Denmark. The outbreak occurred in a barley field at the end of April and beginning of May, the larvae being present in thousands in the upper layers of the soil to a depth of about 2 inches. These flies oviposit during the summer in the ground, the newly hatched larvae appearing in the autumn, but doing very little damage at that time. *Trachea (Hadena) secalis*, Schiff., and *Tortrix paleana*, Hb., were comparatively scarce.

Pests of Leguminous plants included *Apion apricans*, Hbst.; *Macrosiphon pisi*, Kalt.; *Eurydema (Strachia) oleraceum*, L.; and *Tylenchus devastatrix*, Kühn, which was rather less injurious than in previous years.

Beet and sugar-beet were attacked by *Blitophaga opaca*, L., and *Pegomyia hyoscyami*, Pz. The latter was exceptionally abundant and in June and July caused considerable damage in many localities, only the very young leaves escaping injury. The larvae of the second generation appeared in the middle of July, but the plants were then too big to suffer to any great extent. *Aphis rumicis*, L., appeared at

the beginning of July, but the outbreaks were easily checked with nicotine sprays, and at the end of July were stopped altogether by rain and a fungus, *Empusa fresenii*.

As regards pests of swedes and turnips the attacks of the flea-beetles, *Phyllotreta nemorum*, L., and *P. atra*, F., were of shorter duration than during the previous years, probably owing to cold and wet weather in May.

Lucerne pests included *Hypera* (*Phytonomus*) *variabilis*, Hbst., the larvae of which were very common in June and July in some localities and did serious damage. A fungus, *Entomophthora phytonomi*, however killed a great number of them. *Cneorrhinus exaratus*, Marsh., perforated the leaves of lucerne at the Studsgaard experiment station in June. The outbreak of *Luperina* (*Apamea*) *testacea*, Hb., seems to have ceased quite as suddenly as it began in the autumn of 1914. *Aptinothrips rufus*, Gmel., has been noticed on fox-tail grass in May and June, and in one locality an attack of *Amaurosoma flavipes*, Fln., was noticed.

FERDINANDSEN (C.), ROSTRUP (Sofie) and KØLPIN RAVN (F.). **Oversigt over Landbrugslanternes Sygdomme i 1917.** [Report on Agricultural Pests in Denmark in 1917.]—129 *Beretning fra Statens Forsogsvirksomhed i Plantekultur, Copenhagen*, 1918, pp. 313–340.

Comparatively few additional pests are recorded during the year under review.

At the end of May an attack of *Atomaria linearis*, Steph., occurred in one locality, many plants being cut in two. The postponement of thinning, however, had the effect of saving the plants. *Phorbia* (*Chortophila*) *brassicae*, Bch., was exceptionally numerous in June and July, turnips suffering less than swedes. In one locality, where no extensive outbreaks had previously occurred, in many fields 25 per cent. of the crop was destroyed.

Meligethes aeneus, F., did great damage to seed turnips from the beginning of May until July, other turnip pests being *Ceuthorrhynchus assimilis*, Payk., *C. pleurostigma*, Marsh., and *Psylliodes chrysocephala*, L

FERDINANDSEN (C.), LIND (J.) & ROSTRUP (Sofie). **Oversigt over Havebrugplanternes Sygdomme i 1916 og 1917.** [Report on Insect Pests and Diseases of the Orchard in 1916 and 1917.]—*Tidskrift for Planteavl., Copenhagen*, xxvi, 1919, pp. 297-334.

The apple and pear pests recorded include:—Lepidoptera, *Cheimatobia brumata*, L., *C. boreata*, Hb., in some localities, and *Hybernia defoliaria*, Cl., which appeared in May and at the beginning of June all over the country. The injury was especially marked in 1916, particularly in sheltered orchards near woods. In 1917 the attack was considerably less severe. Apples were as a rule more damaged than pears, but some varieties of apples, such as Beauty of Kent, Reinette de France and Pederstrup Reinette, were much less injured than others.

The larvae of *Chloroclystis rectangulata*, L., often occurred in company with *Cheimatobia*. *Argyroploce* (*Olethreutes*) *variegana*, Hb., occurred in 1916 in great numbers in the buds of various fruit-trees. *Eucosma* (*Tortrix*) *ocellana*, F., in 1917 destroyed the buds of young apple-trees

planted in nurseries in 1916. *Blastodacna atra*, Haw. (*putripenella*, Z.) injured the buds of apples and was so numerous in places as to cause complete defoliation. Other Lepidopterous pests included:—*Argyresthia conjugella*, Z., *Cydia* (*Carpocapsa*) *pomonella*, L., *Malacosoma neustria*, L., *Hyponomeuta* sp., *Episema* (*Diloba*) *coeruleocephala*, L., *Vanessa polychloros*, L., and *Orgyia antiqua*, L.

The sawflies reported were *Eriocampoides limacina*, L., and *Hoplocampa testudinea*, Klg.

Anthonomus pomorum, L., was very common in 1916, causing severe injury in May in some localities; in others where the flowers were abundant the thinning effected by this weevil was rather beneficial than otherwise. *Otiorrhynchus picipes*, F., was also reported in one locality in May 1917.

Perrisia pyri, Bch., occurred in July on 1-3 year-old trees, the growth of which was greatly retarded. *Contarinia pyrivora*, Ril., was as usual common on young pear fruits in May and June.

Among Rhynchota, *Calocoris norvegicus*, Gmel., *Lygus pratensis*, L., *L. kalmi*, L., and *Orthotylus marginalis*, Reut. (*nassatus*, Fln.) in many localities attacked apple-trees, in some places pears also. *Psylla mali*, Schmbg., was a serious pest in 1916. *Aphis pomi*, DeG., and other Aphids were present in exceptionally great numbers in spite of the cold and rainy weather. *Lepidosaphes ulmi* was very common in 1916 on apple and pear trees, especially on espaliers and on trees growing in sheltered places.

The mites recorded include *Eriophyes pyri*, Pgst., in many localities, especially on pear trees. *Tetranychus* sp., which during the dry and warm summer of 1917 was exceptionally common, especially on espaliers, the injured trees being easily recognised by the grey colour of the foliage.

Pests of stone-fruits included *Cheimatobia brumata*, L., and *C. boreata*, Hb., on mirabel, plums and cherries: *Argyroploce variegana*, Hb., on morello cherries; *Tortrix funebrana*, Tr., on plums; *Argyresthia ephippiella*, F., on cherries. *Hoplocampa fulvicornis*, Kl., greatly diminished the plum crop in 1916. Plum trees also suffered heavily from the attacks of Aphids, especially *Hyalopterus arundinis*, *F.* (*pruni* F.). *Lecanium* sp. and *Aspidiotus* sp. were recorded on peaches, and apricots.

Pests of gooseberries and currants included *Abraxas grossulariata*, L., and *Pteronus ribesii*, Scop.; *Aphis grossulariae*, Kalt., and *Myzus ribis* L., injuring red currants in some localities; *Schizoneura fodiens*, Buckt., found on the roots of red currants; and the mite, *Bryobia praetiosa*, Koch, which is widely spread and especially attacks old gooseberry bushes. *Eriophyes ribis*, Nal., was very common on black currants, though the injury does not always diminish the crop.

Raspberries and blackberries were attacked by *Byturus tomentosus*, F., *Anthonomus rubi*, Hbst., *Otiorrhynchus* sp., *Incurvaria rubiella*, Bjerk., and *Pennisetia* (*Bembecia*) *hylaeiformis*.

Miscellaneous pests included *Balaninus nucum*, L., common in many localities on hazel nuts; *Aphis sambuci*, L., on elder; *Eriophyes avellanae*, Nal., common on hazel both wild and cultivated; *Crioceris asparagi*, L., and *Calocoris norvegicus*, Gmel., on asparagus; *Hylemyia antiqua*, Meig., on onions and leeks all over the country; and *Acrolepia assectella*, Z., on leeks in some localities.

Cabbage and other cruciferous plants were attacked by flea-beetles (*Phyllotreta nemorum*, L., *P. atra*, F., and other species) which did great damage, especially at the end of April and the beginning of May to cabbage, radish, horse-radish, kohlrabi and ornamental plants such as *Iberis* and *Alyssum*. A Carabid, *Bembidion* (*Bembidium*) *celer*, F., occurred in company with the flea-beetles in one locality and did some damage. Other pests included *Ceuthorrhynchus sulcicollis*, Payk., *C. assimilis*, Payk., and *Meligethes aeneus*, F., on turnips, radishes, etc. The larvae of *Pieris* sp. were much less numerous than usual in 1916, but in 1917 occurred in enormous numbers in July and August. The infestation ceased rather suddenly at the end of August owing to the presence of a fungus (*Entomophthora sphaerosperma*) and a Hymenopterous parasite, *Apanteles* (*Microgaster*) *glomeratus*. *Plutella maculipennis*, Curt., was less numerous in 1916 than is usually the case, but in 1917 the larvae contributed to the damage caused to cabbage by *Pieris*. *Barathra* (*Mamestra*) *brassicae*, L., was especially injurious in 1917 to cauliflowers and *Acronycta rumicis* was also recorded on the same crop. *Phorbia brassicae* was also very injurious in 1916, especially to cauliflowers. *Brevicoryne* (*Aphis*) *brassicae*, Kalt., in July and August appeared in enormous numbers and was the most destructive of all the cabbage pests. At the end of August its attacks were reduced by Hymenopterous parasites and a fungus, *Empusa aphidis*, but too late to save the crop.

Leguminous plants were attacked by *Sitones lineatus*, *L.*, *Cydia* (*Grapholitha*) sp., *Cecidomyia* sp., *Phytomyza albiceps*, Meig. (*pisi*, Kalt.), *Kakothrips pisivora*, Westw. (*Physopus robustus*, Uzel) and *Tetranychus telarius*, L. Carrots, celery and other Umbellatae were attacked by *Psila rosae*, F. (especially early-sown carrots, parsley, celery and parsnips), *Acidia heraclei*, L., and *Trioza viridula*, Zett. Strawberry pests included *Anthonomus rubi*, Hbst., which in many localities did considerable injury in May and June; *Oxygrapha* (*Acalla*) *comariana*, Z., the caterpillars of which spin together the leaves and flower-stalks and feed on them, there being two generations, in June and September; *Blennocampa geniculata*, Stph.; and *Tarsonemus fragariae*, Zimm., which is widely spread all over the country. Other miscellaneous pests were *Calocoris norvegicus*, Gmel., *Gortyna* (*Hydroecia*) *micacea*, Esp., *Sphinx atropos*, L., Aphids and mites on potatoes and tomatoes; *Tetranychus* sp. and *Sminthurus cucumeris* on cucumber and pumpkins; *Pegomyia hyoscyami*, Panz., mining the leaves of spinach; *Gastroidea* (*Gastrophysa*) *viridula*, DeG., on beans and rhubarb; *Agriotes lineatus*, L., and other wireworms injuring many vegetables; *Meloë proscarabaeus*, L., which appeared in the spring of 1917 in enormous numbers in one orchard; *Euxoa* (*Agrotis*) *tritici*, L., the caterpillars of which are much earlier than those of E. (*A.*) *segetum*, Schiff., and devour all kinds of vegetables; *Forficula auricularia*, L., and *Blaniulus guttulatus*, Gerv.

A number of remedial measures are described. *Psila rosae* has been controlled with naphthaline and soot; the larvae of *Hylemyia antiqua* were driven away with naphthaline and by watering repeatedly with soapy water; *Byturus tomentosus* in one orchard has been collected with great success for several years in glasses containing a little water and a few drops of oil, the operation in the fourth year being completed in four hours.

In experiments conducted by the Government Experiment Station the measures that proved effective against the larvae of *Pieris* included Dufour's mixture (6 lb. soap, 3 lb. insect powder in 20 gals. water) and dusting with insect powder and lime (1 : 4) or tobacco dust.

HAMMARLUND (C.). **Blandade Besprutningsvatskor för samtidigt Bekämpande av Skorv och Skadeinsekter pa Appleträd.** [Mixed Sprays against Fungi and Insects on Apple Trees.]—*Meddelande från Centralanstalten för Försöksväsendet på Jordbruksområdet, Stockholm,* no. 134, Botaiska avdel. no. 12, 18 pp., 4 figs., 1916.

The results are given of a series of experiments with mixed sprays carried out in the years 1914–1915 against the fungus, *Venturica dendritica*, and the moths, *Cydia* (*Carpocapsa*) *pomonella*, L., and *Argyresthia conjugella*, Z., the object being to find a combination which could be used simultaneously against both fungi and insects.

The following mixtures were tried: lead arsenate and Bordeaux mixture, copper arsenate and Bordeaux mixture, lead arsenate and lime-sulphur, and copper arsenate and lime-sulphur. It was found that the percentage of fruit infested by *C. pomonella* and *A. conjugella* was reduced from 7·65% to 2–3% on the sprayed trees, the lowest percentage arrived at being 1·18 when the trees had been sprayed with lead arsenate and Bordeaux mixture on the first of June and on the 7th of July. The author is however of opinion that the general infestation was too small for any positive conclusions to be arrived at.

NIELSEN (J. C.) **Tachin-Studier** [Tachinid Studies].—*Videnskabelige Meddel., Copenhagen,* lxix, 1918, pp. 247–262.

This paper contains a review of the author's investigations on the biology of the Tachinids, especially as regards their relation to their hosts and their life-cycle. The geographical distribution of these parasitic flies may be smaller than that of the host, *e.g.*, *Carcelia gnava* a parasite of *Stilpnotia salicis*. The opposite also occurs, and a given species of Tachinid may be dependant on different hosts in various parts of the world, *e.g.*, *Rhacodineura antiqua*, parasitic in Russia on *Forficula tomis* and in western Europe on *F. auricularia*. The hosts to which a given Tachinid is adapted are in some cases only few species or those within a single genus, *e.g.*, *Exorista blepharipoda*, which is only found in larvae of *Acronycta*. Others will only infest insects within a single family, *e.g.*, *Viviania cinerea*, only attacking Carabids. Many Tachinids can however be reared from insects quite different from their principal host, *e.g.*, *Pelatachina* from larvae of *Vanessa*, as well as from those of *Polia* (*Mamestra*) *oleracea*. Most Tachinids are polyphagous and can, for instance, attack Tenthredinid or Chrysomelid larvae as well Lepidopterous ones. Tachinid eggs may sometimes be found on unsuitable hosts. The suitability of a given host is not connected with its systematic position but with external conditions, *e.g.*, the tender larvae of *Tachina mella*, though normally parasitising Lepidopterous larvae, cannot pierce the skin of those of *Porthetria dispar*; or with internal ones, the body fluid of certain unsuitable hosts having specific properties that have a poisonous effect on the parasite. Individual larvae of the same species of Tachinid living in different hosts increase in size at varying rates

according to the development of the host, the growth being slow when the host is hibernating. When solitary, Tachinid larvae are able to live equally well in small hosts as in large ones. The number of individuals occurring in the same host depends on the size of the host, *e.g.*, ten *Viviania cinerea* may occur in *Procrustes coriaceus*, and only one in *Pterostichus niger*; but this is only seldom decided by the parent, and *Winthemia* will deposit up to 100 eggs on one Sphingid larva.

The number of generations a year in Denmark is one or two, possibly more in certain cases, the number being always constant in a given species. Some species exhibit the same number everywhere within their geographical range, but others have more in the south than the north; thus *Tachina fasciata* has one generation in Greenland, and two in Denmark. In an Indian species there are 8 or 9 generations a year. The number of generations does not always conform to that of the host, *e.g.*, *Pelatachina tibialis* infesting larvae of *Vanessa* has only one generation a year, and the majority of Tachinids that have more than one generation will live in hosts having only one, and thus must change their host. Certain species having two generations however do infest hosts having the same number, and do not change their hosts *e.g.*, *Meigenia floralis* infesting *Gastroidea* (*Gastrophysa*) *viridula*.

Tachinids that have one generation emerge in the spring; their larval stage is very short, and they spend ten months in the puparium. *Viviania cinerea*, however, hibernates as a second-stage larva. Tachinids having more than one generation may be met with through the whole summer, and individuals belonging to different generations occur at the same time.

Most of them hibernate as a puparium, but *Subclytia rotundiventris* hibernates as a second-stage larva.

Nielsen (J. C.). **Undersøgelser over entoparasitiske Muscidelarver hos Arthropoder VII.** [Researches on endoparasitic Muscid Larvae in Arthropods].—*Videnskabelige Meddel., Copenhagen*, lxx, 1919, pp. 1–3.

The Tachinid, ***Plagia ruralis***, Fin., has been reared from the caterpillars of ***Phytometra*** (***Plusia***) *gamma*, L., and *P. iota*, L.

Bahr (L.). **Paratyfus hos Honningbien** [Paratyphus in Honey Bees]. —*Skandinavisk Veterinär-Tidsskrift*, ix, 1919, pp. 25–40, 45–60.

An acute enteritis of bees in the vicinity of Copenhagen has been found to be due to *Bacillus paratyphi-alvei*, the bees showing symptoms of debility, inability to fly and sometimes diarrhoea, and dying in from 24 hours to a few days. The disease was introduced with purchased infected bees, and in eight bee-hives 50 per cent. of the bees succumbed in a fortnight. *Bacillus paratyphi-alvei* was found in great numbers in the gut of all the infected bees, often almost as a pure culture, and was also found in the blood. It is not identical with the forms of *B. paratyphi* found in man and domestic animals.

The feeding of healthy bees and of *Vespa* with pure cultures dissolved in 5 per cent. sugar solution showed positive results, but mice, guinea-pigs and rats were not susceptible. While the organism is not normally

found in healthy bees, it has occurred exceptionally. In these cases the infection has possibly been present earlier in such hives, and it is certain that many cases of paralysis and dysentery recorded in bees have been due to paratyphus.

This somewhat infectious and malignant disease can be spread (1) by purchase of infected bees and of apparently healthy bees that originate from a hive that some time previously has been attacked by the disease ; (2) through foreign infected males ; (3) through beekeepers carrying the infection from attacked apiaries to healthy ones ; (4) through infected frames, tools or hives. The author therefore proposes measures controlling the purchase of bees and the prohibition of the importation of foreign bees and queens.

GESCHWIND (A.). **Die der Omorikafichte** (*Picea omorica*, **Panč.**) **schädlichen Tiere und parasitischen Pilze.** [The Animals and parasitic Fungi injurious to the Spruce, *Picea omorica*.]—*Naturwiss. Zeitschr. Forst- u. Landwirtschaft, Stuttgart,* xvi, no. 11-12, November–December 1918, pp. 387–395.

Picea omorica may still be found in a few areas in the Balkan Peninsula. This species of spruce is one that is dying out and in spite of its good qualities is only planted for ornamental purposes in central and southern Europe. The conclusion reached is that injurious insects and fungi have played an important part in hastening its extinction. The following insects have been observed on *P. omorica* :— Coleoptera, *Anobium abietis*, F., *Ips typographus*, L., *I. amitinus*, Eich., *Pityogenes chalcographus*, L., *Hylastes* (*Hylurgops*) *palliatus* Gyll., *Xyloterus lineatus*, Ol., *Cerambyx luridus*, L., and *C. bajulus*, L. Hymenoptera, *Lygaeonematus* (*Nematus*) *abietinus*, Christ., and *Sirex gigas*, L. ; Lepidoptera, *Cydia* (*Grapholitha*) *strobilella*, L. ; and a scale-insect, *Physokermes piceae*, Schr. (*Coccus racemosus*, Ratz.).

SCHEIDTER (F.). **Ueber die Feststellung des Parasitenbesatzes bei Forstschädlingen.** [The Determination of the Degree of Parasitisation in Forest Pests.]—*Forstwissenschftl. Centralblat Berlin*, xli, no. 1, January 1919, pp. 1–15.

In view of the important rôle played by the natural enemies of forest pests this paper describes methods for determining the extent of parasitism present by examination of the larvae and pupae of the hosts. Attention is drawn to the importance of distinguishing between Tachinid and Ichneumonid larvae, and their respective appearance is carefully described. The host larvae or pupae must be gently handled, and as large a number must be collected as can be examined not later than within the next few days. There are some exceptions to this rule. For instance, in the pupae of *Bupalus piniarius* collected in autumn the parasitic larvae are so small as to be easily overlooked, so that the pupae must be kept for some time in a warm room under suitable conditions of humidity. It is necessary to know which stage or stages of the host must be examined. In some species the eggs and in others the larvae or pupae contain the important parasites. In *Lymantria monacha* (nun moth) Tachinids, especially *Parasetigena segregata*, Rond., must be looked for in the older larvae and also in the pupae. The mature larvae and pupae of *Dendrolimus pini*, L., harbour both

Ichneumonids and Tachinids. As however some Ichneumonids leave the half-grown larvae and an egg-parasite also occurs, the best plan is to examine the larvae in spring and the eggs in summer about 2 or 3 weeks after oviposition. This can be done at leisure, for measures against *D. pini* are applied in the following spring when the larvae that have hibernated on the ground begin to ascend the trees. *Bupalus piniarius*, L., is parasitised by Ichneumonids and Tachinids, which may be searched for as soon as all the larvae descend from the trees and begin to pupate, usually in early December. If the formation is urgently required, the pupae should be kept moist in a warm room for 2 or 3 weeks before examination, but it is usually better to delay investigation until the spring. The chief enemy of *Panolis flammea* is a Tachinid, *Panzeria rudis*, and an examination of the full-grown larvae could be made; but as at that time the Ichneumonid parasites are very minute, it is better to postpone operations until autumn, with the further advantage that parasitised pupae are then easily recognised so that the tedious internal examination is unnecessary. Care must be taken, however, to include the Tachinids that have emerged and are present as puparia. Dr. Wolff, of Eberswalde, has recorded an egg-parasite, *Trichogramma piniperda*, in *P. flammea*. Sawflies are much parasitised by Tachinids and Ichneumonids and these may be found in the larvae within their cocoons. Where there are two generation the cocoons may be collected in summer from the branches, bark, etc., and in winter under leaves, etc., on the ground. In the case of a single generation collection must take place in winter. The cocoons may be stored and the parasites counted after they emerge, and the apparently sound cocoons may then be opened. As the sawfly, *Diprion* (*Lophyrus*) *pini*, is sometimes highly infested with an egg-parasite, *Teleas* sp., it is necessary to examine the eggs as well. *Cephaleia abietis* (*Lyda hypotrophica*) and *Acantholyda* (*L.*) *stellata* appear to suffer little from parasites, so that natural control is slow in their case. During the winter an examination must be made of the larvae hibernating in the ground. For some time previously they should be kept in a warm room, on a bed of sand and covered with moss damped periodically, in order to hasten the development of the parasites.

Full directions, quoted from existing literature, are given on the methods of conducting the internal examination of larvae and pupae.

PETRASCHEK (K.). **Einiges über die angewandte Entomologie in Amerika und ihren Einfluss auf die entomologischen Reformbestrebungen in Deutschland und Deutsch-Oesterreich.** [A few Notes on Applied Entomology in the United States and its influence on the Attempts at Entomological Reform in Germany and German Austria.]—*Forstwissenschaftl. Centralblatt, Berlin*, xli, no. 5, May 1919, pp. 161–173.

A brief review is given of the position of applied entomology in the United States due to the ample funds at the disposal of the entomological authorities and to excellent organisation, and the attempts made in recent years to model entomology in Germany on these lines are described. To pave the way for this reform Prof. Escherich and others founded in 1913 the "German Society for Applied Entomology" and arranged the publication of the "*Zeitschrift für*

angewandte Entomologie." He also took the first steps to found in Munich a Research Institute for combating Animal Pests and a sum of £25,000 has been contributed towards the cost by private individuals and by a business corporation. This Institute will investigate insects injurious to crops, stored products, man and animals and will endeavour to ascertain the best means of combating them, special attention being devoted to insecticides. Prof. Escherich regards the diffusion of knowledge relating to pests as the best method of promoting co-operation in the application of preventive and remedial measures and more effective than attempting to deal with the matter by means of legislation. The teachers at the agricultural winter schools and the travelling instructors should be those chiefly responsible for this side of the work. Insect pest inspectors would form the link between the research institute and the government on one side and the public on the other, and would be charged with the duty of carrying out demonstrations in remedial measures. In order to ensure that the Government's policy should be intelligent, the ministry concerned should have an expert consultant.

Prof. Escherich's initiative has found a response not only in Germany but also in German Austria, and Prof. Seitner of Vienna has suggested the formation of a central institute staffed with zoologists and other specialists, the Plant Protection Station in Vienna and the Zoological Department of the Forestry Experiment Institute at Mariabrunn, which deal with applied entomology, being incapable of coping with this additional work. Even if such a central institute is not provided, Prof. Seitner considers temporary observation stations to be very necessary, either in threatened areas or in their immediate vicinity. The appointment of state entomologists, chosen among those graduates of agricultural high schools who show a special leaning towards entomology, is necessary. Their duties would include *inter alia* the making of reports to the central institute and the directing of remedial measures. The education of young entomologists by means of tours of instruction at the expense of the State and a system of exchanges among entomologists are also desirable.

KRAUSSE (A.). **Beobachtungen an *Dasychira pudibunda*, L., gelegentlich des Eberswalder Frasses 1917.** [Observations on *D. pudibunda* during the Eberswald Outbreak in 1917.]—*Zeitschr. Forst- u. Jagdwesen, Berlin*, li, no 5, May 1919, pp. 265–272, 9 figs.

During 1915 and 1916 there was only a slight infestation at Eberswalde of *Dasychira pudibunda*, L. The severe outbreak of 1917 was therefore unexpected and has not been explained. All the caterpillars examined were infected with a polyhedral disease. Cases of severe urtication were recorded, and in some localities the collection of resin had to be interrupted owing to the number of caterpillars that dropped on the workers and their utensils. Early in September the beeches in the forest near Eberswalde were found to be badly defoliated. The caterpillars were also swarming on pine trees, but did not feed on the needles. Few Ichneumonid parasites were seen, but the Carabid beetles, *Calosoma sycophanta* and *Carabus glabratus*, preyed on the caterpillars to a considerable extent. No birds were observed to attack them.

ZACHER (F.). **Die Weissährigkeit der Wiesengräser.** [The White-Ear Disease of Meadow Grasses.]—*Deutsche Landwirtschftl. Presse, Berlin*, xlvi, no. 59, 23rd July 1919, pp. 445–446, 7 figs.

The flowers of many meadow grasses are prematurely yellowed and withered by the attacks of various insects and mites. These include flies of the genera *Oscinella, Meromyza, Elachiptera, Chlorops* and *Cecidomyia*. Some caterpillars injurious to wheat that also attack grasses are *Trachea* (*Hadena*) *secalis*, L., *Anerastia lotella*, Hb., and *Ochsenheimeria taurella*, Schiff. In Finland *Tortrix paleana*, Hb., occasionally injures *Phleum pratense* in this manner. *Cephus pygmaeus*, L., damages meadow grasses in the same way, and the following thrips have also been recorded in this connection :—*Aptinothrips rufus*, Gmel., *Limothrips denticornis*, Hal., *Chirothrips hamatus*, Trvb., and *Haplothrips* (*Anthothrips*) *aculeatus*, F.

In cases where the presence of insects is not apparent the injury is often believed to be due to mites, which escape notice owing to their minute size. Of these, *Pediculoides graminum*, E. Reut., does the chief damage in Finland ; it attacks a great variety of grasses. *Tarsonemus culmicolus*, E. Reut., is a less common species ; and is responsible for about 18 per cent. of this kind of injury. *Tarsonemus spirifex*, March., has been found on grasses (*Avena elatior, Dactylis glomerata, Festuca pratensis* and *Poa pratensis*) in North Germany ; this appears to be the first record of such infestation, this mite being hitherto known on oats and barley only. As the result of his observations in Finland Reuter advises early mowing and speedy harvesting of grasses showing signs of attack. Attention is drawn to the fact that grasses growing alongside paths, etc., may prove a source of infestation for neighbouring meadows.

MARCHAL (P.) & FOEX (E.). **Rapport Phytopathologique pour l'Année 1915.**—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 21–44. [Received 1st September 1919.]

A general review is given of the insects injuring cereals, vegetable crops, fruit and grape-vines, trees and ornamental shrubs and of the work of the entomological and phytopathological stations in various parts of France during 1915.

LATIÈRE (H.). **La Lutte contre les Maladies des Plantes en Italie.**—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 76–144. [Received 1st September 1919.]

An account is given of the history and work of the various stations and laboratories for studying diseases and parasites of plants. The most injurious insects in Italy include *Phylloxera*, the olive fly [*Dacus oleae*], the scale-insects infesting *Citrus*, particularly *Chrysomphalus dictyospermi pinnulifera* (*minor*) and *Icerya purchasi*, the mulberry scale (*Aulacaspis* (*Diaspis*) *pentagona*) and the vine moths [*Clysia ambiguella, Polychrosis botrana* and *Sparganothis pilleriana*]. Minor pests that also cause serious damage are the olive thrips (*Phloeothrips oleae*) *Psylla oleae* and the olive moth [*Prays oleellus*], the woolly apple aphis [*Eriosoma lanigerum*], *Cydia* (*Carpocapsa*) *pomonella* and *Mayetiola* (*Cecidomyia*) *destructor*.

The existing legislation against pests of plants is reviewed in detail; this covers all the known pests in Italy and prohibits the introduction of those from abroad. Sections are devoted to remedial measures against special pests, the bulk of which have already been noticed in this *Review*, and to an account of the introduction of the better known enemies of common pests, such as *Prospaltella berlesei* against *Aulacaspis pentagona* [see this *Review*, Ser. A, i, p. 189, etc.].

The question of introducing the African parasites of *Dacus oleae* has been under consideration for some time and some attempt has been made in this direction [see this *Review*, Ser. A. vi, p. 256]. A difficulty arises in the fact that the wild olives of Eritrea have a skin of only 0·3 to 0·6 mm. thickness, whilst that of the cultivated Italian olives is generally at least 1 mm. Those African parasites that have a short ovipositor cannot therefore be useful in Italy. The species relied upon for control are *Opius africanus*, *O. dacicida*, *Bracon celer*, *Halticoptera daci* and *Allomphalus cavasolae*. If these Hymenoptera become established in Italy, they should prove a very efficient control for *D. oleae*; the development of *B. celer* and *A. cavasolae* is nearly twice as rapid as that of their host, and that of the two species of *Opius* is scarcely less so, these parasites also having a long adult life. It is proposed to establish a temporary laboratory in Eritrea for the study of *D. oleae* and its parasites, with the intention of extending this research into Abyssinia, south-eastern Africa and Asia. Experiments have also been made in the colonisation of *H. daci* and *O. concolor* in France. *Rhizobius lophantae* has been colonised in southern Italy to destroy various scale-insects. The importance of another Coccinellid, *Novius cardinalis*, which was introduced into Italy nearly 20 years ago against *Icerya purchasi* and has subsequently been used with great success in other countries, has frequently been noticed [see this *Review*, Ser. A, i, p. 171, etc.].

LÉCAILLON (A.). **Négril et Galéruque. Notes sur la Biologie du Négril de la Luzerne** (*Colaspidema atra*, **Latr.**) **de la Galéruque de l'Orme** (*Galerucella luteola*, **F. Muller**) **et de la Galéruque de l'Aulne** (*Agelastica alni*, **L.**).—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 145–161. [Received 1st September 1919.]

The habits of these three beetles being similar, they are considered together, and it is hoped that these notes, although incomplete, may be of some assistance in arriving at a rational method for their destruction. The seasonal history of *Galerucella luteola* on elms is discussed [see this *Review*, Ser. A, iv, p. 223], two generations being observed in a year. *Agelastica alni* is universally admitted to have only one generation annually.

In the case of *Colaspidema atrum* only one generation has been recorded by any observer, but the author questions whether there may not be two. This would explain the presence of adults reproducing as late as September. In the neighbourhood of Toulouse both larvae and adults of *C. atrum* may be found in the lucerne fields from mid-April to mid-September. Many records of oviposition of this species are given and show that after a single fertilisation the females can continue to oviposit for a long period. The duration of

the various stages of the life-history of all three species is discussed. It has been thought that larvae or adults of *C. atrum* quickly die when deprived of nourishment; the author's experiments, however, have proved that young larvae, at least, can exist for several days without food. The general manner of feeding in the case of both larvae and adults is to attack the tender parts of the plant. Observations are recorded on the feeding of 17 larvae on lucerne from the time of hatching to the inactive period before transformation. It is evident from these that during the first half of its existence the larva eats much less than the adult, but later, and particularly during the last few days of its development, it eats considerably larger quantities. On the whole, the adult insect is the greater feeder, its period of activity being longer than that of the larvae. The method of feeding and the amount of nourishment required by adults of *G. luteola* and *A. alni* are very similar; each lives for two months or more and eats a considerable quantity per diem throughout this period.

Some account is also given of *Meigenia floralis*, the Tachinid parasite of *C. atrum* [see this *Review*, Ser. A, vi, p. 171].

FEYTAUD (J.). **Recherches sur l'Eudemis et la Cochylis dans le Bordelais en 1914.**—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 218–265, 4 figs. [Received 1st September 1919.]

From a series of observations on *Clysia ambiguella* and *Polychrosis botrana* in the Bordeaux region in 1914 it was ascertained that mortality was high in the winter 1913–1914, varying between 75% and 93% in different localities. The principal factor was the presence of fungus diseases, which were encouraged by the autumn rains and which killed some 46 to 58% of *P. botrana*. Another factor was the activity of Ichneumonid parasites, causing the death of 13 to 22% of *C. ambiguella*. The action of cold on hibernating individuals of *P. botrana* is discussed. The author is convinced that in Gironde the abnormal cold of the winter 1913–1914 did not diminish the numbers of this moth, but rather encouraged its increase by killing off many of its natural enemies. *C. ambiguella* is known to be naturally more resistant to cold than *P. botrana*.

The value of various insecticide treatments is discussed, the formulae for these being given. Tests made in May and June 1914 on eggs of *P. botrana* confirm former results as regards the action of nicotine [see this *Review*, Ser. A, vi, p. 72]. Positive results were obtained with quinoline 1%, phenic acid 1% and potassium sulphocarbonate 1%. Pyrethrum powder 2% gave poor results; sodium sulphoricinate 1% and permanganate of potassium 1% gave negative ones. The successful substances apparently killed the eggs immediately by directly arresting the development of the embryo; pyrethrum, which only prevented development of one-sixth of the eggs, had the same action as nicotine, the larva becoming poisoned at the moment of eating its way out of the egg. The results of various experiments in the field are given. Details of the poison-baits and shelter-traps have already been noticed [see this *Review*, Ser. A, i, p. 415, iv, pp. 309, 492, v, p. 136, vii, p. 90, etc.].

FEYTAUD (J.). **Recherches sur l'Eudemis et la Cochylis dans le Bordelais en 1915.**—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 266–276. [Received 1st September 1919.]

The invasion of *Clysia ambiguella* and *Polychrosis botrana* in 1915 in the Bordeaux region is reviewed, with a further account of bait-traps and records of the results obtained by their use. [See preceding paper.]

PÉNEAU (J.). **Notes sur les Aphides radicicoles.**—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 277–285, 13 figs. [Received 1st September 1919.]

A series of observations are recorded on certain species of root-feeding Aphids occurring in France. Keys are given to the genera, both of the apterous and winged forms, and a key to the species of the genus *Trama*. *T. caudata*, del Guerc., which is recorded for the first time in France, is described. It was observed at Nantes in 1913 on chicory roots. Aphids of this genus are found on lettuce, chicory, cardoons, artichokes and other Composite plants, causing considerable damage, particularly to young plants, the development of which is arrested. As is the case with most subterranean Aphids, they are accompanied and protected by ants, and the primary remedial measure against the former is the removal of the latter. This is done by destroying the ant-nests in the spring by pouring in an emulsion of coal-oil, coal-tar or creosote. Without the ants the Aphids soon die, as they cannot travel far to seek food and are quickly attacked by fungous diseases.

KOWALSKI (J.). **Un Ennemi du Cocotier aux Nouvelles-Hébrides: le *Promecotheca opacicollis*, Gestro.**—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 286–327, 2 plates, 8 figs. [Received 1st September 1919.]

The Hispid beetle, *Promecotheca opacicollis*, Gestro, has been known since 1909 as a pest of coconut palms in the New Hebrides. In 1913 the author was appointed to undertake a through investigation of this insect and of its natural enemies. The original description of the beetle is quoted. The adults are almost invariably found on the underside of the leaves, where they rest, feed, and oviposit. The beetles seldom fly, and if disturbed, frequently drop to the ground. The injury to the leaf takes the form of longitudinal slits in the tissue of the underside, following the veins. Other palms similarly injured by the adults are *Areca catechu*, *Phytelephas macrocarpa*, a species of *Phoenix* and *Ravenala madagascariensis*. The larvae, however, do not attack these trees, perhaps owing to the hardness of the tissues.

The eggs of *P. opacicollis* are protected by a sort of shield constructed by the female from particles of the epidermis of the leaf cemented together by a viscid substance. This is carefully built up over the eggs as they lie on the underside of the leaf. The capsules are generally isolated, but may occur in groups of two; they measure from 2·5 to 4 mm. and contain from 2 to 5 eggs. In this respect the species differs from that occurring in the Philippines (*P. cumingi*), the eggs of which are laid singly. After an incubation period of about 18 days the larvae hatch and pierce holes in the lower epidermis of the leaf and attack

the chlorophyll of the parenchyma. The female of *P. cumingi* in the Philippines pierces this hole before laying the egg. The larva continues to extract chlorophyll from the leaf within which it lives and develops, causing a drying up and blistering which are the characteristic signs of its presence. There are at least two larval moults; on examination of imagines that had died without being able to effect their exit, shed skins were found indicating three larval moults, and this may be the correct number. Owing to the larva living within the leaf the length of the various larval stages has not been ascertained, but the total larval life is probably from 35 to 37 days. Pupation occurs within the leaf and lasts from 8 to 10 days, the imago emerging by piercing a hole in the upper epidermis. The length of the various stages of *P. opacicollis* in the New Hebrides and of *P. cumingi* in the Philippines are compared. In the Philippines the adult remains from two to four days within the leaf before emerging, and the same probably occurs in the New Hebrides.

The damage caused by the adults is more restricted and would seem less serious than that by the larvae, but the continual laceration caused by the repeated nibbling finally results in almost equal damage. The young leaves at the head of the tree are generally the first attacked, palms of less than three years old being seldom injured.

A Hymenopterous parasite of the eggs of *P. opacicollis* was collected by the author and is described as *Oligosita utilis*, sp. n. The method of parasitising the eggs, which occurs after the construction of the capsule, is described, the ovipositor of the parasite being sufficiently long to penetrate the eggs within. Oviposition is, however, a difficult matter, requiring from six to fifteen minutes, or even longer. During a three hours' observation the parasite was seen to parasitise at least 16 eggs. It is evident that the parasite is common, and should be of great value to planters. At the time of these observations the number of parasitised eggs of *P. opacicollis* was about 40 per cent., but this figure varies considerably in different localities. It is suggested that efforts should be made to equalise the numbers of the parasite by transporting it from localities where it is abundant to others where the pest is far in excess of the parasite. Another Hymenopteron, *Closterocerus splendens*, sp. n., is described as parasitic upon the larvae of *P. opacicollis*. This species is allied to *C. insignis*, Waterst., from Ceylon. The method of parasitisation is described, the eggs of the parasite being inserted into its victim through the epidermis of the leaf that shelters it. Only the third-stage larvae are attacked, the individuals of the previous stages probably being too small to provide nourishment for the development of the parasite. Whether the pupae also are attacked, as is the case with the Philippine species, is not known. *C. splendens* appears to be disseminated throughout the Archipelago, but less abundantly than *O. utilis*, and is very easy to breed. The larva when fully developed leaves its host and pupates in about four days, the adult emerging about 15 days later. Other Hymenopterous parasites of *Promecotheca* exist, but cannot yet be identified, though two have been recognised as belonging to the *Entedon* group, while another is probably a Proctotrupid.

Predaceous enemies of *P. opacicollis* include ants, which destroy many of the larvae and are always abundant on coconut palms, and certain birds. It is suggested that the latter should be encouraged

in every way by making shelters for them, particularly among cotton trees, which are preferred for nesting. On some coconut palms as many as 50 per cent. of the capsules were found broken open either by a bird, by lizards or by snakes.

Artificial remedies against *Promecotheca* include the shaking down and collecting of the adults, which is an easy matter owing to their sluggishness; this can be most successfully done in the early morning. If the insects are on low trees a sheet laid on the ground is sufficient to catch them, but on high palms large nets raised on bamboo poles must be used. Torches have been used with good results, but smoke fires only drive the insects further afield. The use of insecticides does not seem very promising owing to the situation of the larva within the leaf. Fumigation with hydrocyanic acid gas would give excellent results in plantations of three- or four-year-old palms, but cannot be used on older and taller ones.

The geographical distribution of this beetle, the history of its occurrence and the manner of its spread are discussed and illustrated by a map. Outbreaks are generally localised, although the insect occurs more or less numerously throughout the New Hebrides. When the supply of food becomes exhausted in one spot, swarming takes place to some fresh area, for the females do not care to oviposit upon leaves that have already been severely attacked. This explains the sudden disappearance of the insect from a formerly heavily-infested spot and its sudden outbreak in a fresh direction. A table shows the spread of *Promecotheca* in various localities and during various periods in the archipelago. While a good deal of damage may be caused to coconut palms if many of the leaves are attacked, *P. opacicollis* has only been known in a very few instances to cause the actual death of the plant, and in those cases the palms were of the native variety and old. In every case of severe attack however there is a considerable diminution in vigour, the blossoming is poor and the crop scanty. The exact extent of loss due to the pest has not been definitely ascertained, but in both Vaté and Epi it has been estimated at about $\frac{2}{3}$ of the total crop of copra.

In view of the fact that outbreaks are localised, that the greatest damage is done during the first invasion of the insect in a given locality and that the beetles move slowly from place to place, it is evident that co-operation is necessary among planters in combating this pest. One infested area can soon infect a whole region if prompt action be not taken. Besides the remedial measures indicated above, the vitality of the palms should be augmented in every way, by suitable and active manures, by constant cultivation of the ground and by the sowing of plants that will serve as green manure.

PAILLOT (A.). **Observations et Expériences sur les Champignons parasites des Insectes.**—*Ann. Service des Epiphyties, Paris,* iv (1915), 1917, pp. 329–334. [Received 1st September 1919.]

In March 1914 a fungous disease was found to be very prevalent among *Hylesinus* on ash-trees and was identified as *Beauveria globulifera*. The disease took a somewhat different form from that caused by the same fungus on *Haltica amphelophaga*, probably owing to the different method of hibernation, the latter beetles congregating in great number

near the ground and consequently living in a moist atmosphere, while the former do not congregate closely and are found higher up the tree. About the same time a severe attack of *Beauveria densa* was raging among the caterpillars of *Hepialus* feeding underground in a nursery near Paris and destroying the roots of garden plants. This disease has previously been noticed chiefly among white grubs, which have similar habits to *Hepialus*. In 1911 larvae of *Clysia ambiguella* and *Polychrosis botrana* in a vineyard at Germolles (Saône et Loire) were found infected to the extent of some 80 per cent. by *Spicaria farinosa* var. *verticilloïdes*, and in 1913 the disease was again prevalent. In the course of this investigation a weevil of the genus *Rhynchites* was found which was attacked by a different fungus that proved to be *B. globulifera*, and it would therefore appear that these vine-moths possess a certain immunity to this disease. In the Jura, under the bark of pines infested with Bostrychids, a number of larvae of *Tomicus* and some large Scolytid larvae were found mummified owing to the attacks of *Spicaria farinosa* and of *Botrytis bassiana*, known as a silkworm parasite.

The method of producing large quantities of spores of *S. farinosa* adopted in 1913, and the trial of the *verticilloïdes* variety by means of an emulsion sprayed upon vines against *C. ambiguella* and *P. botrana* are described. The experiment gave negative results, none of the caterpillars showing any signs of the disease. A second experiment with fungi, especially *Sporotrichum globuliferum*, against *Eriosoma lanigerum* proved equally unsuccessful, although the conditions were all favourable to the fungus. It is thought that possibly better results might be obtained with spores of greater virulence, but the point is doubtful.

Paillot (A.). **Note sur le Criocère de l'Asperge et ses Parasites.**—*Ann. Service des Epiphyties, Paris*, iv (1915), 1917, pp. 335–336. [Received 1st September 1919.]

During 1914 the asparagus beetle [*Crioceris asparagi*] was very abundant about Auxonne and Dijon, but its activities were limited by the presence of two parasites, *Tetrastichus asparagi*, Crawf., found only in the Auxonne district, and a Tachinid, *Meigenia floralis*, which does not seem to occur in the Auxonne plantations, but is frequently found at Dijon. *T. asparagi* pierces the eggs of the asparagus beetle with its ovipositor and then sucks all the contents of the egg through the hole thus made. The number of empty, flattened eggs found on the plants testifies to the value of this enemy. In some of the eggs that appear intact eggs of *T. asparagi* have been laid; this does not prevent hatching, and the larvae harbour from three to as many as nine parasites within their body-cavity until the moment of pupation; they then die and the parasitic larvae pupate. It would be interesting to discover more of the biology of this Chalcid and the manner in which it subsists from one year to another, with a view to increasing its numbers and introducing it where necessary. The species has been studied in the United States, but has not previously been recorded in Europe [see however this *Review*, Ser. A, vi, p. 171]. The other parasite, *M. floralis*, is much better known; in asparagus plantations at Dijon the majority of larvae of *C. asparagi* carried 3 or 4 eggs of this fly on the outside of their bodies.

MARCHAL (P.) & FOEX (E.). **Rapport Phytopathologique pour les Années 1916 et 1917.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 1–35. [Received 1st September 1919.]

The administrative measures for the protection of cultivated plants and the organisation of campaigns against insect pests and diseases are reviewed. The insects reported during 1916–1917 include pests of cereals, vegetables, fruit-trees, grape-vines, forest and shade-trees, and olives and other crops confined to the south of France.

Hyponomeuta malinellus was abundant on apple trees and *H. padellus* on plums, blackthorn and hawthorn. In view of the serious damage caused by the former moth, and the fact that it was recently introduced into Canada on apple-trees [see this *Review*, Ser. A, v, p. 447], the importance of horticultural inspection during May and the destruction of larvae and pupal masses before July is urged. This is done by clipping the trees and burning the cuttings; lead arsenate sprays are also beneficial. Caterpillars of *Hepialus lupulinus* damaged the roots of gooseberry, privet and other bushes in late autumn, killing off any young trees. Carbon bisulphide injections are the best remedy, and in nurseries rows of salad plants, lucerne, etc., may be grown as trap-crops. *Sitotroga cerealella* and larvae of *Pyrausta nubilalis* damaged maize in the Pyrenees. A good remedy against *Pieris brassicae*, which was one of the worst cabbage pests in 1917, was to plant at intervals thick rows of Jerusalem artichokes or hemp as though for shelter. The butterflies did not oviposit on cabbages so protected. A parasite, *Apanteles glomeratus*, was fortunately abundant, as well as *Pteromalus*. *Agromyza abiens* is increasing rapidly and has greatly injured artichokes in the eastern Pyrenees, where they are an important crop; *Cassida viridis* also attacked them. Nursery pine-trees were attacked by *Myelophilus piniperda* and by a species of *Dioryctria*, probably *D. mutatella*, Fuchs, about which little is known, its depredations frequently being attributed to *M. piniperda*. Elms were largely infested with *Galerucella luteola* in 1917, an egg-parasite of this beetle, *Tetrastichus xanthomelaenae*, being very much in evidence.

FEYTAUD (J.). **Essais d'Application du Traitement arsenical contre le Ver des Pommes** (*Carpocapsa pomonella*, **L.**).—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 36–48. [Received 1st September 1919.]

Experiments with various arsenical mixtures are described, and their effect on *Cydia* (*Carpocapsa*) *pomonella* is discussed. The question of the most economical method of treatment is raised, and it is demonstrated that the amount expended in controlling an insect pest, when the treatment is efficient and opportune, is an investment returning a high rate of interest. In the case outlined the return was 700 per cent. after adequate treatment. While remedial measures are always an expensive matter and labour is often scarce, it is very difficult to induce a trial of new methods, and the author contrasts the French attitude with that of the United States, where cultural methods follow the dictates of science with beneficial results to the cultivator. The treatment of apples against *C. pomonella* should become as much a current agricultural practice as that of vines against the vine-moths.

The formulae used all contained the proprietary brand of lead arsenate known as Bouillie Billault, which consists of about half its weight of lead arsenate, 100 parts by weight of the powder corresponding to 48 of triplumbic arsenate, to 20 of disodic ortho-arsenate or to 12 of arsenic acid. This, mixed with water alone, gave some measure of success, but any of the following showed far greater efficacy :—15 parts Billault mixture, 1 part sodium carbonate, 6 parts oleine white soap, 1,000 parts water; or 15 parts Billault mixture, 2·5 parts adhesol to 1,000 parts water; or 15 parts Billault mixture with 10 parts copper acetate to 1,000 parts water. Probably the spreading properties of these were an advantage, while the copper in the last-named would add to its efficiency. Tables are given showing the results of sprays with these mixtures, both as regards the growing trees and the fruit crops; the quantity of sound fruit gathered was found to be doubled by the less efficacious treatment given on the 26th May, almost five-fold after the treatment on 8th May only, and nearly six-fold after the combined sprayings.

LÉCAILLON (A.). **Sur l'Emploi des Insecticides arsenicaux pour combattre la Pyrale des Pommes et des Poires** (*Carpocapsa pomonella*, **L.**).—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 49–53. [Received 1st September 1919.]

In consequence of the success of arsenicals against *Cydia pomonella* in the United States, the author made a trial of the same method in 1917 on apple and pear trees in Haute Garonne. On account of unfavourable climatic conditions, the state of the trees left much to be desired, but the results were sufficient to confirm the efficacy of arsenical treatment. For apples the treatment should be begun as soon as the petals have fallen, but for pears it should be later, when the moths first appear. For early-maturing pears a single spraying is generally sufficient. Lack of success on apple-trees in France is probably frequently due to the difficulty of making the material generally used penetrate the eye of the fruit.

MASSONNAT (E.). **Applications de la Méthode arsenicale à la Culture fruitière de la Région lyonnaise.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917) 1918, pp. 54–59. [Received 1st September 1919.]

Experiments are described that were undertaken in three different localities of the Lyons region to test the value of arsenicals against *Cydia pomonella*. These confirm the fact that such measures can be completely efficacious and indicate the value of popularising the use of these insecticides in that region.

PÉNEAU (J.). **Emploi des Arsenicaux contre les Insectes des Arbres fruitiers, en particulier contre le Ver des Pommes et des Poires** (*Carpocapsa pomonella*, **L.**).—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 60–68. [Received 1st September 1919.]

A series of experiments are described in which eight different arsenical mixtures were tested against fruit-tree pests. Excellent results were obtained with two sprayings, the first after the dropping

of the petals and the second 5 to 6 weeks later. The most convenient mixture proved to be 15 lb. of Billault mixture of lead arsenate to 100 gals. water. As a result of these measures, the insect pests attacking the foliage and young fruits practically disappeared; these include *Hyponomeuta* spp., *Malacosoma* (*Bombyx*) *neustria*, saw-flies, etc. The percentage of fruit infested by *Cydia pomonella* was reduced to almost nil and the crop increased, in spite of the fact that the treatments were unavoidably begun rather late.

RABATÉ (E.). **Essais d'Insecticides arsenicaux.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 69–73. [Received 1st September 1919.]

The results are given of several years' study in the preparation of various arsenical insecticides. Their action upon fruit pests, including *Hyponomeuta padellus*, *H. malinellus*, *Cheimatobia brumata*, and *Cydia pomonella*, is discussed, and the conclusion is reached that a copper-lead-arsenate solution gives results that ordinary Bordeaux mixture cannot, and that the use of arsenicals should become general in orchard work.

MARCHAL (P.). **La Lutte hivernale contre la Pyrale de la Vigne** (*Oenophthira pilleriana*, **Schiff.**) **par l'Emploi des Arsenicaux.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 74–82, 4 figs. [Received 1st September 1919.]

The emergence of the young caterpillars of *Sparganothis* (*Oenophthira*) *pilleriana* from their winter quarters covers a long period, being dependent upon the depth to which they have penetrated. This fact, and the difficulty of treating the insects during their injurious period, renders most important the winter measure for destruction of the young larvae while still under the bark by means of hot water or fumigation under a bell-jar. For some years a tendency has been growing in many southern vineyards to adopt as an alternative the application of insecticides in the form of sprays or washes towards the end of the hibernation period. Soluble arsenicals have given the greatest success, and have been used by special permit for winter treatment of vines. The results of experiments described in this paper indicate that arsenical soap solutions, containing on an average 3·5 per cent. of sodium arsenite and used towards the end of winter in sufficient quantities to moisten completely the stems and branches, are a certain remedy for *S. pilleriana*, and give as good results as the hot-water treatment with less expense and less labour. The immediate death of a certain number of larvae is the result of this measure, followed some weeks later by a secondary toxicity causing a far greater mortality. This is explained by the slow penetration of the insecticide through the bark and the faculty possessed by the larvae of absorbing the atmospheric moisture surrounding them through the mouth.

MIÈGE (E.). **La Désinfection du Sol.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 83–144, 3 figs. [Received 1st September 1919.]

The various processes of soil disinfection are reviewed and recent experiments in this method of controlling insect and fungous pests

are described. The methods of contamination and constant re-infestation of the soil are also discussed.

The treatment of the soil with carbon bisulphide proved of value against *Loxostege* (*Phlyctaenodes*) *sticticalis*, injurious to tobacco, beetroot, etc., while as many as 94 per cent. of Acarids present have been destroyed by the same means. Injections at a depth of about 10 in. destroys the larvae of the beetle, *Leucopholis rorida*, which in Java destroys the roots of cassava [see this *Review*, Ser. A, iv, p. 82]. Carbon bisulphide and sulphur vapour are also recommended against the eggs of *Tachycines* and *Diestrammena marmorata*, crickets that infest greenhouses. The weevil, *Tychius quinquepunctatus*, which was very injurious in 1915 in Italy, should also be controlled by this method.

Sulphocarbonate of potassium has the same effect but is more expensive and more troublesome to use. Toxic substances in less common use for injections are toluine and benzine, which have been used with success against turnip pests, and benzol and calcium bisulphide against certain thrips. It has been proposed as a remedy against *Lepidiota albohirta* infesting sugar-cane in Australia that toxic substances should be mixed with the soil with the object of poisoning the larvae which are accustomed to ingurgitate a quantity of soil as they eat. The Ministry of Agriculture in Italy has tried various antiseptic substances against locusts, of which a solution of soap and coal-tar has given the best results.

Measures complementary to the antiseptic treatment of the soil are disinfection of seeds, protection from other sources of contamination and the use of resistant varieties. It is hoped that soil disinfection will become one of the regular agricultural practices in France, as is already the case to some extent in the United States and in England.

FEYTAUD (J.). **Etude sur l'Otiorhynque sillonné** (*Otiorrhynchus sulcatus*, **F.**).—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 145–192, 17 figs. [Received 1st September 1919.]

The various stages of *Otiorrhynchus sulcatus* are described, with the life-cycle and seasonal history [see this *Review*, Ser. A, v, p. 340]. Studies on the parthenogenesis of this species are also recorded in detail [*op. cit.*, vi, p. 72].

The weevils attack the tender vine shoots and feed during the night, cutting away and destroying the leaf-buds. Later they attack the branches, eating away the bark and leaving large scars. The leaves are eagerly devoured in captivity, but at Saint-Pierre d'Oléron, where the author's investigations were made, this rarely occurs in nature, at least before the middle of August. The larvae live in the soil during the winter, cutting through the smaller vine roots and attacking the larger ones more or less severely, and wounding the trunk, weakening it until it eventually dies. Severe outbreaks of this pest have been recorded in Belgium, Germany, Italy and France. A list is given of other weevils of the same genus, to the number of about 30, attacking vines in Europe [*op. cit.*, vi, p. 172], with many records of their attacks on other food-plants, including strawberries, raspberries, apples and peaches. The natural enemies of *O. sulcatus* are dealt with at some length; these include moles, shrews, hedgehogs, birds, reptiles, toads, Carabid beetles and *Cerceris arenaria*, L. [*op. cit.*,

vi, p. 172]. Certain parasites of *Otiorrhynchus* spp., such as the Braconid, *Blacus tuberculatus*, are less well-known, as well as some Diptera. It is also suggested that attempts might be made to infect these weevils with certain fungi that are known to develop readily on other Curculionids, or some bacteria may be discovered that are virulent to them. The natural enemies of *O. sulcatus* should be encouraged. After ploughing, when the larvae and pupae are exposed, poultry and especially turkeys should be turned into the vineyards; hedgehogs also should be introduced into infested land, the damage they may do to the vines being more than compensated for by their value in controlling *O. sulcatus*.

Against the larvae, submersion, where practicable, is a successful remedy. Liquid insecticides have not proved very beneficial as a wash on the vines, the larvae being too widely disseminated in the ground. Insecticides in the form of gas are better, especially carbon bisulphide injected into the ground. From May to September, while the adults are on the trees, solutions such as Bordeaux mixture, nicotine-sulphur sprays, Bordeaux mixture with nicotine or aloes, etc., act as repellents and stop the spread of infestation; these need renewing every 8 or 10 days during June, July and August. Arsenical or other poison sprays applied to the foliage also require constant renewal. The latter treatments are not of much use except in conjunction with the repellent sprays, otherwise the insects are simply driven away from one centre of infestation to form another. The destruction of other food-plants has not much effect as the weevils can live on the vine throughout the year. The most successful and practical control of the adults has proved to be hand-collection. This must be done at night, when the weevils are on the vines and they can be picked off one by one, or, better, shaken off into a sheet or basin of liquid.

An account is given of the invasions of *O. sulcatus* in Saint-Pierre d'Oléron which the author has studied since 1913, and of the work of the syndicate formed in 1914 to combat it [*op. cit.*, ii, p. 229 and v, p. 40]. Owing to the energetic measures carried out, the infestation in 1915 and 1916 was of diminishing extent. The cost of the three years' campaign was approximately £93 over an area of about 150 acres. The result of these campaigns was the almost total disappearance of the pest in 1917, and it is urged that in the case of similar outbreaks in other localities the same measures should be taken, *i.e.*, the establishment of a syndicate to organise co-operative collections encouraged by rewards.

Paris (P.). **Recherches sur la Bionomie des Oiseaux des Vignes.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 210–229. [Received 1st September 1919.]

Among the birds frequenting vineyards, some are distinctly beneficial, a few are definitely noxious and the majority are sometimes useful and sometimes harmful, the balance being very difficult to determine in some cases. A complete list is given of birds that nest in vineyards and feed largely upon injurious insects, the most useful in this respect being a bunting (*Emberiza hortulana*), which is the greatest enemy of *Clysia ambiguella* both in the larval and adult stage. The only bird causing any serious injury to vines is the starling

(*Sturnus vulgaris*), which attacks the mature fruit, but even this bird has a beneficial effect on the vines at any other season. These beneficial birds should be protected whenever possible from predaceous animals, especially as many of them nest on the ground; in cultivating the vineyards also care should be taken not to destroy the nests. The construction of special shelters for these birds and the planting of suitable trees about the vineyards are the best means of encouraging these most efficient enemies of vine pests.

FEYTAUD (J.). **Notes sur l'Eudémis et la Cochylis dans le Bordelais en 1916 et 1917.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 230–237. [Received 1st September 1919.]

This paper gives an account of the occurrence of *Clysia ambiguella* and *Polychrosis botrana* in vineyards around Bordeaux during 1916 and 1917, with notes on the use and efficacy of bait-traps.

CAPUS (J.). **Invasion des Cultures de Pois en Gironde par** ***Heterodera schachtii*****, Schmidt.**—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 239–244. [Received 1st September 1919.]

An account of the damage to peas in Gironde by the Nematode, *Heterodera schachtii*, and the subsequent infestation of the plants by the fungus, *Fusarium vasinfectum*, has previously been described [see this *Review*, Ser. A, v, p. 471]. As a remedial measure it is suggested that the pea crop should be alternated with one that is not attacked by this Nematode. When peas are infested, the plants should be pulled up immediately after the crop is gathered, and burnt. The ground should then be dug up and dried as much as possible; if peas or some other susceptible crop, such as beets, oats, turnips, cabbages, must then be grown, they should not be sown until late in January.

Rapports sommaires sur les Travaux accomplis dans les Laboratoires et Comptes Rendus des Missions d'Etudes.—*Ann. Service des Epiphyties, Paris*, v (1916–1917), 1918, pp. 253–272. [Received 1st September 1919.]

The work of the various entomological and pathological stations at Paris, Blois, Bordeaux, Montpellier, Saint-Genis-Laval and Cadillac during 1916 and 1917 is here reviewed, as well as the special investigations undertaken under the direction of the sanitary and scientific services. Almost every station was badly handicapped by shortage of staff owing to the War and by the mobilisation of the directors. In 1917, a new insectarium was established at Mentone, chiefly on the initiative of the syndicate of olive-growers of Nice and Provence, for the study of remedial measures against the insect pests of southern crops and the acclimatisation of their natural enemies. Colonies of *Novius cardinalis* were bred as a control for *Icerya* sp. and the African parasites of *Dacus oleae* were dealt with, but the season was unfavourable for rearing *Opius concolor*. Investigations were undertaken at Cannes for remedial measures against *Chrysomphalus dictyospermi* on oranges. A mixture of 8 lb. lime and 16 lb. sulphur with sufficient water to make 10 gals. was sprayed on the trees in February–March,

on 11th April and in the latter half of June. In July, August and September further treatments were given wherever the scale was present. One month after the spraying of 11th April the condition of the trees was decidedly better and many dead scales were found. By the autumn, the treated trees (to the number of 600) showed very few scales, while an untreated orchard, separated from them by a road only, was at the maximum of infestation just as in the spring of 1916.

LINNANIEMI (W. M.). **Applespinnmalen** (*Hyponomeuta malinellus*, **Zell.**). [The Apple Ermine Moth.]—*Meddelanden till Landtman, Helsingfors*, no. 49, 1917, 8 pp., 5 figs.

The paper gives a short account of the biology economic importance and enemies of the apple ermine moth and of the methods of controlling it. Until 1896, this moth was only recorded from the south-western districts of Finland, but after 1911 it seems to have been gradually spreading to other parts of the country as far as 63° N. Lat. The outbreak seems to have reached its height in 1915, the moth having disappeared in the following year in many localities. As remedial measures the author suggests spraying the eggs or the young larvae with 8 per cent. carbolineum emulsion in early spring or spraying the larger larvae later with lead arsenate.

HUKKINEN (Y.) **Blasfotingar (Thysanoptera), hvilka i vårt land angripa Åkerväxter.** [Thysanoptera that attack Agricultural Plants.]—*Meddelanden till Landtman, Helsingfors*, no. 50, 1917.

After a short introduction dealing with the general characteristics of thrips and their development, biology and distribution, the author deals with the following species: *Aptinothrips rufus*, Gmel., *Limothrips denticornis*, Hal., *Frankliniella* (*Physapus*) *tenuicornis*, Uzel, *Physapus vulgatissimus*, Hal., *Chirothrips manicatus*, Hal., *C. mamatus*, Tryb., *Haplothrips* (*Anthothrips*) *aculeatus*, F., *H.* (*A.*) *statices*, Hal., and *Kakothrips pisivorus*, Westw. (*Physapus robustus*, Uzel.).

As remedial measures against those species that cause withering of the heads of the cereals, harrowing and burning the stubble immediately after the harvest or early in the following spring are suggested. Against *Aptinothrips rufus* it is advisable not to have meadows on the same ground for too many years in succession. Against *Limothrips denticornis* the growing of oats is suggested instead of barley, rye or wheat in the rotation of crops, since this insect does not seem to thrive on this cereal. *Frankliniella tenuicornis* has repeatedly been ascertained to prefer 6-rowed barley to the 2-rowed variety.

REUTER (E.). **Den biologiska Metoden vid Bekämpandet av Skadeinsekter.** [The Biological Method of controlling noxious Insects.]—*Föredrag och Uppsatser utgivna av Nylands Fruktodlare-förening, Helsingfors*, no. 7, 1919, 59 pp., 43 text figs.

The author gives a summary of the different biological methods of dealing with insect pests, and suggests the following way of combating the apple ermine moth (*Hyponomeuta malinellus*) in Finland. As the larvae of this moth and those of *H. euonymellus* have the same

parasites, those of the latter should be utilised against the former. The cocoons of *M. euonymellus* should therefore be collected and kept in the orchards in boxes closed by wire netting of such mesh as to permit the escape of the parasites but preventing that of the moths.

MØRK-HANSEN (K.). **Bekaempning av Geometra-larver paa Bøgekimplanter ved Sprøjtning med Fluegift.** [Combating Moth-larvae on Beech Seedlings by spraying with Quassia-Extract.]—*Fra Skoven og Traemaredet, Copenhagen,* i, no. 13, 1919, 2 pp.

The caterpillars of moths such as *Hybernia defoliaria* and allied species, which were defoliating beech-seedlings, have been successfully combated by spraying with quassia extract. This method was employed because it was impossible at the time to procure arsenical sprays. The extract was made from 10 lb. quassia shavings in 2 gals. boiling water, the fluid after about one hour being passed through a sieve and mixed with lime-water.

TRÄGÅRDH (Ivar). **Några allmänna men hittills föga uppmärksammade Barkborrar och deras Gångsystem.** [Some common, but hitherto very little known Bark-beetles and their Galleries.]—*Statens Skogsförsöksanstalt, Stockholm, Flygblad* no. 17, 1919, pp. 237–248, 8 figs.

This leaflet is a supplement to an earlier one [see this *Review*, Ser. A, vi. p. 89] and deals with the following bark-beetles: *Hylastes glabratus*, Zett., *H. cunicularius*, Er., *Cryphalus abietis*, Rtzb., *Phloeophthorus spinulosus*, Rey, *Ips proximus*, F., *Dryocoetes autographus*, Rtzb., and *Pityophthorus micrographus*, Gyll.

H. glabratus occurs only in northern Sweden, not being found south of Dalecarlia. It attacks spruce trees felled during the winter. The brood-gallery is straight, longitudinal, 3 mm. wide and 4–6 cm. long, and the egg-galleries are only found near its point of origin. *H. cunicularius* has not previously been recorded as harmful in Sweden, the injury caused by it having to all appearances been overlooked. In the published catalogue of the Coleoptera of Sweden it is only recorded from the south, but the author has found it as far north as in Jämtland. *C. abietis* was previously only recorded from Västergötland; but has been found by the author all over Sweden. It attacks as a rule only stunted trees, belonging to the so-called fourth stratum, according to the Swedish forest terminology. As examples of this, two horizontal sections of trees killed by this beetle are figured, one, measuring about $1\frac{3}{4}$ inches at breast height, being 70 years old, and the other, measuring about $1\frac{1}{4}$ inches, being 80 years old. In the south of Sweden this species has probably two generations a year.

P. spinulosus confines its attacks to the lower branches of old spruce trees or to branches that owing to insufficient light and air succumb in the struggle with others. *Ips laricis* has, as previously pointed out, been confused with *I. proximus*, and therefore no reliable data exist regarding its geographical distribution. It attacks both spruce and pine trees and seems to be one of the most important secondary pests known in Sweden, as it was found ovipositing on trees

felled during July and August in the previous summer. The author suggests that the very irregular shape of the egg-galleries is due to the fact that the beetles, as the latest to arrive, are forced to make use of the limited space left between those of the other species.

Dryocoetes autographus is also decidedly a secondary pest, being found ovipositing in trees felled during July-November in the previous year, and often making use of the entrance holes of other species. *Pityophthorus micrographus*, Gyll., is found in the smallest twigs of spruce trees, its galleries being characterised by their great depth.

CHRYSTAL (R. N.). **The European Elm Sawfly Leaf-miner.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 8, August 1919, pp. 725-728, 1 fig.

Kaliosysphinga ulmi, Sund., recently reported on elm trees in Canada, is described. About the middle of May the eggs are inserted into the leaves and there hatch after about a week. The young larvae immediately commence burrowing in the leaves, as many as 25 mines having been noticed in one leaf; they continue to be destructive for about three weeks. When full-grown they pierce the wall of the mine and drop to the ground. Hibernation in this stage occurs at a depth of about one inch in a light cocoon and continues until the following April, pupation occurring about the beginning of May. The Scotch and English elms seem to be the favourite food-plants.

The remedial measures advocated are spraying both sides of the leaves, as soon as the slightest injury is noticed, with one of the following solutions: 1 pint of 40 per cent. nicotine sulphate, 100 gals. of water and 5 lb. of soap; 1 pint of Black-leaf 40, 100 gals. of water and 9 lb. of laundry soap; or 1 part stock kerosene solution to seven parts of water. As the adults do not emerge from pupae buried deeper than one inch; the removal of a thin layer of soil covering an area exceeding by a foot or two the greatest expanse overshadowed by the trees and burying it at a depth exceeding 6 inches is suggested. To be effectual this must be completed before 1st of May.

CAESAR (L.) & ROSS (W. A.). **The Apple Maggot.**—*Ontario Dept. Agric., Toronto*, Bull. no. 271, May 1919, 32 pp. 17 figs.

The bulk of the information contained in this bulletin on *Rhagoletis pomonella* has been noticed elsewhere [see this *Review*, Ser. A. vii, p. 212, etc.].

PHILLIPS (W. J.) & EMERY (W. T.). **A Revision of the Chalcid Flies of the Genus *Harmolita* of America North of Mexico.**—*Proc. U.S. National Mus., Washington*, lv, 1919, pp. 433-471, 9 plates.

This paper, written with a view to facilitating the identification of Chalcids belonging to the genus *Harmolita* (*Isosoma*), includes separate keys to the sexes. The species described include: *H. grandis* Riley, infesting the centre of the stems of wheat and found wherever this food-plant is grown; *H. tritici*, Fitch, forming galls at the second or third internode of wheat-stems from the base; *H. vaginicola*, Doane, forming galls in the sheath surrounding the head of wheat and preventing grain ormation; *H. websteri*, How., infesting the centre of rye stems and found in Indiana, Ohio, Pennsylvania, California and Illinois;

H. secalis, Fitch, attacking rye and forming galls about the second or third internodes from the base; *H. hordei*, Harris, forming galls above the second to fourth internodes in barley; *H. albomaculata*, Ashm., breeding in the centre of the stems of timothy grass (*Phleum pratense*); *H. captiva*, How., forming galls near the base of the seed stalk, and *H. poae*, sp. n., living in the centre of the stem of blue grass (*Poa pratensis*); *H. dactylicola*, sp. n., inhabiting the stem of cock's-foot grass (*Dactylis glomerata*).

The following species were reared from *Elymus*: *H. elymi*, French, which inhabits the stems and breeds in the spurs, and *H. rufipes*, sp. n., *H. hesperus*, sp. n., *H. ovata*, sp. n., *H. elymoxena*, sp. n., *H. elymicola*, sp. n., *H. elymophila*, sp. n., *H. elymivora*, sp. n., and *H. elymophthora*, sp. n., all of which are gall formers. *H. maculata*, How., breeds in the stem of cheat (*Bromus secalinus*) and other species of *Bromus*. Species reared from *Agropyron* are: *H. agropyrophila*, sp. n., which inhabits the stems; *H. agropyrocola*, sp. n., which lives in the stems and forms galls; *H. atlantica*, sp. n., which forms galls, sometimes occurring in the sheath surrounding the head; *H. occidentalis*, sp. n., which forms galls near the head of the plant and inhabits the stem. *H. festucae*, sp. n., forms galls in the second to fourth internode from the base of *Festuca*; and *H. poophila*, sp. n., has been reared from galls on *Poa lucida*.

Gillette (C. P.). **Eighth and Ninth Annual Reports of the State Entomologist of Colorado for the Years 1916 and 1917.**—*Office of the State Entomologist, Fort Collins*, Circ. nos 21 and 26, June 1917 and May 1918, 31 and 52 pp. [Received 3rd September 1919.]

These reports include those of various county horticultural inspections and record the following pests: *Aspidiotus perniciosus* (San José scale), which is becoming less abundant; *A. ancylus* (Putnam scale), which has appeared in certain districts on cherries; *A. howardi*, which is fairly common on pears, though the damage caused is not very great; *Cydia* (*Carpocapsa*) *pomonella* (codling moth), which is still one of the most serious pests in orchards; and *Tortrix* (*Archips*) *argyrospila* (fruit-tree leaf-roller), which has proved very troublesome. Experiments show that spraying with insecticides is not to be depended on for killing the eggs of this moth. The most effectual treatment was the use of hot water at a temperature of 140°F. applied for about 10 seconds.

Eriophyes pyri (pear-leaf blister-mite) has shown a preference for apples in certain localities, the fruit being either blemished or reduced in size owing to leaf injury. The adults hibernate under and about the bud scales. It can be easily controlled by using lime-sulphur as a dormant spray each second or third year. *Gossyparia spuria* (elm scale) is still spreading, but its ravages may be checked by the use of soluble oil as a dormant spray; a strong stream of water has also been effectual on low trees. *Prionoxystus robiniae* (black locust borer) is gradually destroying all the black locust trees (*Robinia pseudacacia*). *Pulvinaria innumerabilis* (cottony maple scale) is best controlled by spraying with 15 to 18 per cent. kerosene emulsion before the buds open in the spring. Experiments made with nicotine sulphate show that all nymphs

of *Aphis pomi* were killed at a strength of 1 to 800 and over, but even the weakest solution used, 1 to 1,500, was effective, the fact that a few individuals escaped being probably due to lack of thoroughness in application; to avoid this, soap at the rate of 3 lb. to 100 gals. of solution was added to ensure more even distribution. This addition proved to be of considerable benefit in aiding the liquid to penetrate the curled leaves. The same solutions were used against the mealy plum aphis, *Hyalopterus arundinis*, F., but the results were less satisfactory, though its numbers were sufficiently reduced to prevent injury to plum and prune trees before the migration of the Aphids to other food-plants. Sprays of lime-sulphur (1 to 40 or 45) proved effective in checking *Paratrioza cockerelli*, Sulc., on tomatoes. Although the growth of the plant was temporarily checked, no vital injury was caused by this application and the insects were reduced to a negligible number. Nicotine sulphate, even at a strength of 1 to 200, proved useless against this Psyllid.

CAMPBELL (R. E.). U. S. Bur. Entom. **A Suggestion of a possible Control of Pea and Bean Weevils.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 284–288.

Observations show that late planting is an efficient measure against infestation by the horse-bean Bruchid, *Bruchus rufimanus*, in California. Provided there is plenty of moisture in the soil and water for irrigation and the spring weather is not too hot and dry, this method of planting after the oviposition period is over will prove successful. It is suggested that owing to the similarity of the life-history this measure might also be applicable against the pea weevil, *Bruchus pisorum*, and possibly other allied Bruchids.

The eggs of *Bruchus rufimanus* are laid from the middle of March to the middle of May on the surface of green pods. They hatch in 9 to 18 days and the larvae at once bore into the pod where they feed for about 10 to 15 weeks. Pupation occurs in the eaten out cell of the bean and lasts from 7 to 16 days. The adults live from 1 to 8 months. They may leave the bean at once or remain in it for several months. They may be seen as early as August, but in storage 90 per cent. are dead by the first of April.

SMITH (H. S.). **On some Phases of Insect Control by the Biological Method.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 288–292.

The biological control of insect pests, involving the increase by artificial manipulation of already existing entomophagous insects in infested regions is discussed. The chief points to be considered in work undertaken on these lines are: the comparative reproductive capacity of the host and the available entomophagous insects; the powers of locomotion both of the pests and their natural enemies; the sequence of available entomophagous insects; the possibility of rearing or obtaining these insects in sufficient quantities; the cost of producing natural enemies in comparison with the value of the crop and any known artificial control; the presence of secondary parasites

in the local fauna and unfavourable agricultural practices. That this method may be successful in some cases is proved by the complete control obtained over the citrus mealy-bug [*Pseudococcus citri*] in some orchards in California by the continued liberation of large numbers of enemies, chiefly the Coccinellid, *Cryptolaemus montrouzieri.*

Ferris (G. F.). **Observations on some Mealy-bugs (Hemiptera; Coccidae).**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 292–299, 3 figs.

Attention is drawn to the fact that *Pseudococcus citrophilus*, Claussen, is a synonym of *P. gahani*, Green, described from England on *Ribes sanguinea.* This species has undoubtedly been introduced into California and England, but its original home is not yet known.

P. maritimus, Ehrh. (*bakeri*, Essig), is recorded for the first time from England, where it occurs on various plants in green-houses, and from Florida on sweet potato, tomato and avocado. Other species are *P. pini*, Kuw., which is reported for the first time from California, and is redescribed; *P. bromeliae*, Bch., reported from Florida on roots of bananas, pineapples and citrus, and redescribed; *P. virgatus*, Ckll., also redescribed; is recorded on *Magnolia*, mulberry, oleander and an undetermined weed from Florida; and *P. comstocki*, Kuw., for which a number of food-plants are recorded, seems to have a wide distribution in the United States and its introduction into California is to be feared. A species already existing in California on Monterey pine very much resembles *P. comstocki* and is probably a monophagous strain of it.

The synomymy of other species is discussed. *P. quercus*, Ehrh., previously erroneously treated as a synonym of *P. crawii*, proves to be a good species, *P. quercicolus*, Ferris, being a synonym of it. *Lachnodius salicis*, Ferris, is a synonym of *L. phoradendri*, Ckll.; and *Ripersia trichura*, Ckll., and *Eriococcus salinus*, Ehrh., of *Cryptoripersia arizonensis*, Ehrh.

Woglum (R. S.) & Rounds (M. B.). U.S. Bur. Entom. **The Stratification of Liquid Hydrocyanic Acid as related to Orchard Fumigation.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 300–303, 1 plate.

The fact that water and hydrocyanic acid have been drawn from the same drum led to numerous experiments the object of which was to determine whether or not stratification occurs when the two liquids are mixed. Observations of which details are given show that this phenomenon always occurs where one liquid is added slowly to the other irrespective of the order in which they are mixed. The same results were obtained with distilled water as with tap water.

When hydrocyanic acid was kept in galvanised iron drums and mixed with water, a white precipitate was noticed at the junction of the two fluids, which on examination was found to contain zinc in solution. To avoid stratification only liquids of uniformly high purity should be mixed. It has also been shown that stratification hastens decomposition.

SEVERIN (H. H. P.). **Notes on the Behaviour of the Beet Leafhopper** (*Eutettix tenella*, **Baker**).—*Jl. Econ. Entom.*, *Concord, N.H.*, xii, no. 4, August 1919, pp. 303–308.

The behaviour of *Eutettix tenella* during the period of swarming and mating is described. This insect appears to be most active at night and is occasionally attracted to light.

DOANE (R. W.). U.S. Bur. Entom. **Weevils in Australian Wheat in California.**—*Jl. Econ. Entom.*, *Concord, N.H.*, xii, no. 4, August 1919, pp. 308–312.

Owing to shipping difficulties arising out of war conditions, wheat has had to be stored for an unusual length of time in Australia. No provisions had been made for the accumulation of such large quantities, and ample opportunities were thus afforded for infestation by weevils and other insects. In grain eventually shipped to California the following beetles were found: *Calandra oryzae*, *C. granaria*, *Tribolium confusum* (confused flour beetle), *T. castaneum* (*ferrugineum*), *Silvanus surinamensis* (saw-toothed grain beetle), *Rhizopertha dominica* (lesser grain borer), *Laemophloeus minutus* (flat grain beetle), and *Tenebroides mauritanicus*. The cosmopolitan parasite of grain weevils, *Mesaporus calandrae*, How., was also very abundant. On arrival at San Francisco some of the sacks had as much as 80 to 90 per cent. of their contents injured by weevils. The grain was taken straight from the docks to the mills where it passed through the usual screens to remove the straw, unthreshed heads and other rubbish. Before use it passed through suction cleaners that draw off the light grain, weed seeds, weevils, etc. These screenings, if containing very many beetles, were burned, but if a good deal of grain was retained, were used as food for pigs, sheep or poultry. All mills handling this infested wheat were urged to make some provision for the destruction of the insects. Experiments made show that exposure to heat, with a steam pressure of 80 to 150 pounds for twelve hours, killed all the beetles. Various kinds of boxes and rooms were equipped for this purpose, details of which are given. In some cases the wheat was sprayed by means of hand-pumps with carbon tetrachloride at the rate of 2 U.S. gals. of liquid to 30 tons of the grain. Wheat treated in this way is not injured, and if the bins are tightly closed for at least two or three days, all weevils in them will be found dead.

SEVERIN (H. H. P.). **Investigations of the Beet Leafhopper** (*Eutettix tenella*, **Baker**) **in California.**—*Jl. Econ. Entom.*, *Concord, N.H.*, xii, no. 4, August 1919, pp. 312–326, 1 plate.

Many food-plants have been recorded for the beet leaf-hopper, *Eutettix tenella*, Baker, the majority belonging to the saltbush family (Chenapodiaceae), especially species of *Atriplex*. A list of plants is given on which eggs have been deposited. These include *Atriplex expansa*, *A. rosea*, *A. semibaccata* (Australian saltbush), *Salsola kali* var. *tenuifolia* (Russian thistle), and *Erodium cicutarium* (stork's-bill).

As the food-plants in the cultivated area become dry the adults leave them. The earliest record of their disappearance is between 25th

September and 10th October. Adults have been taken on *Erodium cicutarium* growing in the foothills about 4 miles from the cultivated area. During the winter they seek the hills that are sparsely covered with this plant and are exposed to the sun in the morning and afternoon. The invasion of the cultivated area begins about 24th April and continues to 21st May. No adults were seen in the cultivated area from 7th to 22nd April, but nymphs were found on beets showing symptoms of curly leaf. These probably hatched from eggs deposited by a few adults that hibernated in the cultivated area and died after oviposition. This species does not undergo complete hibernation. Under experimental conditions the longest period during which adults survived without food was 29 days. Under field conditions the egg-period varied from 16 to 38 days during September to February. In cages the first nymphs hatched 15th April, and 22 adults were reared between 15th June and 27th June, the nymphal instars covering about 30 days. The second brood began to hatch on 10th September, the first adult appearing 21st October. In another experiment 12 adults were reared between 17th June and 4th July from eggs deposited on 14th March. The adults of the second brood appeared from 5th to 15th November. In view of the winter migration of the insects from cultivated areas, it is suggested that beet should be planted early if weather conditions render it at all possible. In certain districts *E. tenella* was found to remain on Australian saltbush all the year. As the seed is distributed by birds, there is danger of this plant spreading to beet fields, in which case even early planted beets may become infested.

Observations made to determine how curly leaf is transmitted to sugar-beet show that the insects cannot produce the disease unless they have fed on diseased plants. Thus adults feeding on beets in the cultivated area which harbour the disease transmit it to *Erodium* to which they migrate in the autumn. The nymphs that have already hatched from eggs deposited on this plant thus become virulent, and the adults to which they give rise transmit the disease again to the cultivated area. Lists are given of plants from which *E. tenella* was collected and those from which it was bred and transmitted curly leaf to sugar-beets.

BURKE (H. E.). U.S. Bur. Entom. **Biological Notes on the Flatheaded Apple Tree Borer** (*Chrysobothris femorata*, **Fab.**) **and the Pacific Flatheaded Apple Tree Borer** (*Chrysobothris mali*, **Horn**).—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 326–330.

The Buprestid beetle, *Chrysobothris mali*, Horn, is much more common in the Pacific States than *C. femorata*, F., and it is believed that a great deal of the damage ascribed to the latter in these States and the Rocky Mountains is really caused by *C. mali*. Both species do a considerable amount of damage to fruit and shade-trees and resemble each other closely in habits, seasonal history and nature of injury. A list is given of the food-plants recorded for the two species and those from which they have been bred, including a great variety of orchard and forest trees.

The different stages are described and compared. The eggs are laid singly on the bark during June and July. As soon as they are hatched the young larvae bore into the bark and mine down to the wood, where they tunnel backwards and forwards through the outer wood and inner bark until they are full grown. The pupal cell is formed in the outer wood or bark. Observations indicate that in California both species pass the winter as prepupal larvae in the cells. Some individuals pass through two winters in this stage. The pupal stage lasts from 2 to 8 weeks according to climatic conditions, and the adults remain in the pupal cell from one to several weeks. Young beetles of *C. femorata* have been found in the cells from 28th March to 9th August, those of *C. mali* from 16th April to 7th August. In the field the beetles have been taken from 15th May to 11th August and 24th April to 7th August respectively.

The remedial measures advocated include the cutting away of the dead bark and covering the wound, after killing the borer, with a dressing of coal-tar or liquid asphalt. Any kind of protection that keeps the sun from the exposed bark is also desirable.

FERRIS (G. F.). **Lac-producing Insects in the United States (Hemiptera, Coccidae).**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 330–333.

It having been thought that a lac insect, *Tachardia larreae*, Comst., occurred in sufficient abundance in the south-western parts of the United States on the creosote bush (*Covillea glutinosa*) to make the commercial recovery of the lac possible, investigations on the point were undertaken and are here described. The results show that lac cultivation under natural conditions cannot be adopted as a successful commercial enterprise. Artificial propagation of the insect has not been tried, as the expense would be great and would probably only yield negative results.

HERBERT (F. B.). **Insect Problems of Western Shade Trees.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 333–337.

The necessity for controlling shade-tree pests from the point of view of the value of these plants as well as the probability of their spread to fruit trees is discussed. Remedial measures suggested include planting the trees further apart to allow the sun to penetrate and the use of power-sprays.

The most important shade-tree pests include :—*Gossyparia spuria*, L. (European elm scale) ; *Ehrhornia cupressi*, Ehrh. (cypress bark scale) ; *Saissetia oleae*, Bern. (black scale) ; *Pseudococcus citri*, Risso (citrus mealy bug) ; *P. longispinus*, Targ. (long-tailed mealy bug) ; *P. maritimus*, Ehrh. (*bakeri*, Essig) ; *P. gahani*, Green (*citrophilus*, Claussen) ; *P. aurilanatus*, Mask. (golden mealy bug), which is especially harmful to *Araucaria bidwilli*, *A. excelsa* and *A. imbricata* ; *Stomacoccus platani*, Ferris (sycamore scale) ; *Physokermes insignicola*, Craw (Monterey pine scale) ; *Toumeyella* sp. ; *Aspidiotus pini*, Comst. (*californicus*, Coleman) (California pine-leaf scale) ; *Icerya purchasi*, Mask. (cottony cushion scale), which causes particular damage to

boxwood and acacias; *Aulacaspis rosae*, Bch. (rose scale); *Epidiaspis piricola*, del Guerc. (Italian pear scale), which attacks the Christmas berry; *Aspidiotus perniciosus*, Comst.; and *Eulecanium* (*Lecanium*) *corni*, Bch.

In addition to the above scale-insects the following pests are of importance: *Phryganidia californica*, Pack. (California oak worm); *Therina somniaria*, Hulst (oak worm looper); *Phloeosinus cupressi*, Hopk., and *P. cristatus*, Lec. (cypress bark-beetles); *Agrilus angelicus*, Horn (oak twig-girdler); *Prionoxystus robiniae*, Peck. (carpenter worm), which injures oaks, elms and cottonwoods; *Chrysobothris femorata*, F., and *C. mali*, Horn (flat-headed borers), which destroy the cambium of many shade as well as fruit trees; and the bark-beetles, *Pityophthorus pubipennis*, Lec., destroying oaks, and *Dendroctonus valens*, Lec., *Ips radiatae*, Hopk., and *I. plastographus*, Lec., destructive to pines.

MORRILL (A. W.). **The Value of Molasses and Syrups in Poisoned Baits for Grasshoppers and Cutworms.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 337–343.

The history of poison-baits with reference to molasses is reviewed and recent observations made by the author on baits for *Melanoplus differentialis* and *Feltia annexa* are described. Results show that in most cases the addition of molasses or syrups to baits for grasshoppers and cutworms is unnecessary.

DE ONG (E. R.). **Effect of excessive Sterilization Measures on the Germination of Seeds.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 343–345.

In experiments made to ascertain whether the germination of seeds is affected by fumigation or heat, various crops were tested of which a list is given, comprising 58 varieties. The results all show that the method is safe both for grains and legumes at the dosages commonly used, provided that the proper precautions as to length of exposure and ventilation afterwards are taken. The details of the effects on beans of exposure to heat, hydrocyanic gas and carbon bisulphide are given. The most striking variation was noticed in beans, showing a range of germination from 22 to 100 per cent., though the average of the whole group proved only 5 per cent. less than that of the control.

COCKERELL (T. D. A.). **On the Absence of Insect Pests in certain Localities and on certain Plants.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 345–347.

Observations show that in certain localities some crops are free from particular pests. It is therefore pointed out that it is an important function of entomologists to ascertain the optimum regions for given crops, and maps should be prepared to indicate these.

Stearns (L. A.). Some recently recorded Parasites of the Oriental Peach Moth.—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 347–348.

In the course of investigations on the Oriental peach moth, *Cydia (Laspeyresia) molesta*, Busck, an average of 35 per cent. of the larvae and pupae were found to be parasitised. The parasites reared included the Tachinid, *Euzenillia variabilis*, Coq., which was the only Dipterous parasite secured. It probably attacks the larvae prior to pupating. *Macrocentrus* sp., which also infests *Cydia pomonella*, attacks the larvae and spins its cocoon within that of the host. A secondary parasite, *Dibrachys boucheanus*, Ratz., was taken from cocoons of *Macrocentrus* within which it had pupated. *Rhogas platypterigis*, Ashm., *Habrobracon gelechiae*, Ashm., *Eubadizon gracilis*, Prov., *Goniozus* sp. and *Leucodesmia nigriventris*, Gir., attack the larval stage; whereas *Itoplectis conquisitor*, Say, *Pimplidea aequalis*, Prov., and *Phaeogenes (Centeterus)* sp. attack the prepupal or pupal stages.

Safro (V. I.). The Strength of Nicotine Solutions.—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, pp. 349–351.

It is pointed out that the only accurate method of judging the nicotine content of nicotine solutions is to indicate also the specific gravity of the solution. The inaccuracy of judging the strength by odour, colour or percentage by weight, without taking into consideration the specific gravity, is emphasised. In three commercial preparations all labelled 40 per cent. nicotine, the weight of nicotine per gallon varied from 2·97 lb. to 4 lb.

Hartzell (A.). European Elm Scale.—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, p. 351.

Attention is drawn to the appearance of the European elm scale, *Gossyparia spuria*, on American elm in Iowa.

Felt (E. P.). European Corn Borer (*Pyrausta nubilalis*, Hübn.) in New York.—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, p. 351.

Recent determinations have positively established the occurrence of *Pyrausta nubilalis*, Hb., in New York State. In certain districts what was thought to be the same pest has now been identified as *Pyrausta penitalis*, Grote.

Britton (W. E.). Corn Borer in Connecticut not the European Species.—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, p. 351.

Adult moths reared from material collected in Connecticut in March, and thought to be *Pyrausta nubilalis*, Hb. [see this *Review*, Ser. A, vii, p. 284], have been now identified as *P. penitalis*, Grote.

BRITTON (W. E.). **Swarms of Aphids.**—*Jl. Econ. Entom., Concord, N.H.*, xii, no. 4, August 1919, p. 351.

On 23rd and 24th June Aphids, subsequently identified as *Calaphis betulaecolens*, Fitch, appeared in New Haven, Connecticut, in such numbers as to be a nuisance to pedestrians and vehicles. They had probably migrated from birch trees on the outskirts of the town.

WODSEDALEK (J. E.) & SMITH (R. H.). **Zoology and Entomology.**—*Univ. Idaho Agric. Expt. Sta., Moscow*, Bull. 113, December 1918, pp. 32–34. [Received 3rd September 1919.]

Observations continued in 1918 with regard to the clover aphis [*Aphis bakeri*, Cowen] show that it survives the winter in various stages of development in the clover crowns. Except during a few weeks in October and November, parthenogenesis is the normal method of increase. The reproductive period of each individual lasts about nineteen days, an average of 81 young being produced. About October and November certain winged forms migrate to apple and other fruit trees. They feed on the leaves of these trees and give rise to sexual individuals. After mating each female lays two eggs on the young twigs. These hatch early in the spring and feed and multiply on the leaves. Winged forms return to the clover. The majority of the Aphids, however, continue to multiply parthenogenetically during the winter on clover.

The remedial measures advocated are the destruction of hibernating places by close grazing, using sheep on clover fields, orchards, ditch banks and waste places, late spring grazing by sheep of both red and alsike clover, flooding infested clover fields with irrigation water and spraying alsike clover.

RITCHIE (A. H.). **Potatoes attacked by Insects.**—*Jl. Jamaica Agric. Soc., Kingston*, xxiii, no. 7, July 1919, p. 221.

An outbreak of *Laphygma frugiperda* (fall army worm) is reported on potatoes. Dusting with lead arsenate diluted with two or three times its volume of ashes or lime is advised against it.

BLACKMORE (E. H.). **Entomology.**—*Rept. British Columbia Provincial Mus. Nat. Hist., 1918, Victoria*, 7th March 1919, pp. T.6–T.13, 2 plates.

A very heavy infestation of tent caterpillars, *Malacosoma pluvialis*, Dyar, occurred during the year in British Columbia. All kinds of fruit and shade-trees were attacked. The butterflies, *Aglais californica*, Bdv., and *Vanessa californica*, were also present in large numbers, as well as the alfalfa-looper *Phytometra* (*Autographa*) *californica*, Edw.

Hemerocampa vetusta gulosa, Hy. Edw., is recorded for the first time from British Columbia. This moth caused serious damage to Douglas fir, on which both full-fed larvae and imagines were taken on 6th August, proving it to be double-brooded.

The apple-maggot fly, *Rhagoletis pomonella*, has been found, but so far there is no evidence of it attacking the apple in British Columbia,

its food-plant being the common snowberry (*Symphoricarpus racemosus*). A list is also given of the more uncommon insects taken in British Columbia during the year under review.

Gibson (E. H.). **A Review of the Leafhoppers of the Genus *Gypona* North of Mexico.**—*Proc. U.S. National Mus., Washington*, lvi, 1919, pp. 87–100.

A key to the Genus *Gypona* is given, with descriptions of eight new species. These leaf-hoppers often occur in considerable numbers in limited areas, assuming the proportions of a concentrated outbreak.

Regan (W. S.). **Late Dormant *versus* Delayed Dormant or Green Tip Treatment for the Control of Apple Aphids.**—*Massachusetts Agric. Expt. Sta., Amherst*, Bull. no. 184, July 1918, pp. 47–57. [Received 3rd September 1919.]

The results obtained in these experiments are summarised by the author as follows :—The delayed dormant period is usually indicative of the complete hatching of apple Aphid eggs. At this time the buds have expanded from a quarter to half an inch. Lime-sulphur solution at full dormant-season strength is less than 10 per cent. effective against the living Aphids when applied at the delayed dormant period. Lime-sulphur applied at the late dormant period, before the buds split open and just before the hatching of the eggs, appears to be highly effective under favourable conditions in destroying the eggs, but the elements of thoroughness of application and unfavourable meteorological conditions present such uncertainty as to results that this treatment can hardly be recommended as an effective control. If lime-sulphur is to be used as a control for San José scale [*Aspidiotus perniciosus*] and no special treatment for apple Aphids is to be made later, the best results against Aphids are likely to be obtained by a late dormant-season application just before the eggs hatch. Treatment at this time should also be thoroughly effective against the scale. The application of lime-sulphur (1 to 8) and nicotine sulphur (1 to 800) combination applied at the delayed dormant period gives practically a perfect control for apple Aphids and makes unnecessary a separate earlier application of lime-sulphur for San José Scale. The percentage of efficiency will depend mainly upon thoroughness of application. The ordinary dormant-season treatment of apple orchards with miscible oil against San José scale, if applied thoroughly at the delayed dormant period, should result in practically a perfect control of apple Aphids also. Delayed dormant applications of full dormant-season strength lime-sulphur, lime-sulphur and nicotine sulphate combined and miscible oils, if perfect, can be made without material injury to apple foliage. Even when the foliage is considerably more advanced, little severe injury usually results. This fact, if taken into account, might make unnecessary separate applications for early and late-budding varieties. As the foliage becomes more advanced, however, the success of the treatment involves greater difficulty, since the Aphids are very hard to reach when they have the spreading leaves for protection. The action of lime-sulphur in

destroying both the Aphid eggs and living insects appears to be mainly mechanical, by sticking them to the twigs. The action of nicotine-sulphate in killing the living Aphids is slow, requiring from about half an hour to twenty four hours or more for different individuals. Death appears to be due to paralysis. Miscible oils are practically instantaneous in their killing action against the living Aphids, the effect being probably of a chemical nature.

VINAL (S. C.) & CAFFREY (D. J.). **The European Corn Borer and its Control.**—*Massachusetts Agric. Expt. Sta., Amherst*, Bull. no. 189, March 1919, 71 pp., 2 plates, 1 map. [Received 3rd September 1919.]

This bulletin deals at length with the life-history, distribution and control of the European corn borer, *Pyrausta nubilalis*, in Massachusetts. A list of food-plants is given. Parasites include the Tachinids, *Masicera nyoidea*, Desv., *Exorista pyste*, Wlk., *E. nigripalpis*, Tns., and *Phorocera erecta*, Coq., which attack the larvae. Hymenoptera attacking the pupa are *Epiurus pterophori*, Ashm., and *Amblyteles brevicinctor*, Say. At present these parasites are not of much use in the control of *P. nubilalis*.

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept., St. Kitts-Nevis, 1917–18 ; Barbados*, 14th July 1919, pp. 15–16 & 39–40.

The cotton worm, *Alabama argillacea*, appeared in very much smaller numbers during the year under review, but cotton-stainers [*Dysdercus*] were much more prevalent. Owing to indiscriminate planting of cotton the leaf blister mite [*Eriophyes gossypii*] appeared in greater abundance in certain localities.

ALEXANDER (W. B.). **The Prickly Pear in Australia.**—*Inst. Science and Industry, Melbourne*, Bull. no. 12, 1919, 48 pp., 16 figs, 1 map.

Some 20,000,000 acres of land in Queensland and 2,750,000 acres in New South Wales are at present infested with prickly pear, and it is estimated that the pest is spreading in Queensland at the rate of 1,000,000 acres a year. Prickly pears have also established themselves in various localities in Victoria, South Australia, and Western Australia, but are not at present serious pests in these three States. Eleven species of prickly pear have become naturalised in Australia, but *Opuntia inermis* is the species whose spread has been so serious and which occupies the great bulk of the pear-infested land.

This bulletin deals with the uses and extermination of these plants, and in connection with the latter, attempts have been made to utilise the services of several insects. So far, *Dactylopius* (*Coccus*) *confusus indicus* and *D.* (*C.*) *confusus capensis* have been introduced into the country and have proved successful in combating the tree pear (*Opuntia monocantha*), but these cochineal insects die as soon as they are transferred to other species.

There are many insects known to be destructive to prickly pears, but their introduction into Australia is not advisable owing to their

omnivorous habits. The following species, the food-plants of which are believed to be confined to cactus, have been suggested for introduction into Australia :—*Moneilema crassum* and *Caenopaeus palmeri*, two Longicorn beetles from the United States, the larvae of which bore in the stems and joints of the plant and the adults feed gregariously on the young segments ; a weevil, *Gerstaeckeria hubbardi*, from Florida, which produces cavities facilitating secondary infection by micro-organisms and scavenging flies ; a Phycitid moth, *Melitara prodenialis*, from the United States, Mexico and West Indies ; *Mimorista flavidissimalis*, a Pyralid moth from Texas, West Indies and Brazil ; *Cactoblastis* (*Zophodia*) *cactorum*, a Phycitid moth from Argentina ; Coreid bugs of the genera *Chelinidea* and *Narnia* ; *Itonida opuntiae*, a gall-midge that is found in the United States to attack cactus under hot-house conditions ; and another Cecidomyid, *Asphondylia opuntiae*, also from the United States, the larva of which lives in the fruit, preventing the development of seed and consequent spread of the pest [see also this *Review*, Ser. A, iii, pp. 125–127].

The following recommendations adopted by the Executive Committee of the Commonwealth Advisory Council of Science and Industry in December 1916 are appended.

That investigations should be carried out as to the suitability of insects and fungi known to be inimical to prickly pear for acclimatisation in Australia, as to the method of action of such insects or fungi on the pear, and as to such other matters as may arise in connection with any biological or chemical researches found necessary.

That the work should be placed under the authority of a biological expert, who should be responsible to the Executive Committee of the Advisory Council of Science and Industry, and who should receive a salary of £1,200 per annum.

That three laboratories, comprising one central laboratory and two subsidiary laboratories, should be established and maintained in Queensland and New South Wales.

That the central laboratory should be established at Brisbane, where the insects would be received immediately they reached Australia, and where the staff would have access to literature and facilities for the use, for special investigations, of University and Government laboratories.

That the two subsidiary laboratories should be established in country infested with prickly pear. One of these should be in New South Wales, whilst for the other the Queensland Government's offer of the Dulacca Experiment Station should be accepted. These stations would carry out the work of breeding and testing the introduced insects, and should be in charge of thoroughly qualified entomologists, at salaries of £750 per annum.

That field laboratories should be established, at such places and at such times as may be deemed necessary by the biologist in charge, for the purpose of introducing such insects as are found suitable into particular areas, or for other special purposes.

That the sum of £8,000 per annum for a period of five years should be made available for this work, of which sum £4,000 should be contributed by the Commonwealth Government and £2,000 each by the Governments of New South Wales and Queensland.

LEGHORN (M. L.). **A Note on the Vitality and Longevity of Silkworm Moths during the Cold and Rainy Seasons in Bengal.**—*Jl. & Proc. Asiatic Soc. Bengal, Calcutta*, xv, no. 2, June 1919, pp. 101–105, 2 plates.

Observations made in Bengal to ascertain the time of maximum vitality and longevity of silkworms show that the moths stand changes of temperature better than rises of humidity. For this reason vitality was lowest in the rainy season in August and September, almost stationary in April, May and June, and highest in December.

The moths used for these experiments, which are being continued, are now in their 56th generation.

A table is given showing the exact length of life of all individuals and the duration of the respective larval and pupal stages. In December the length of life of the moths was 19 days and over, whereas in August the average was only 3 days.

Notes on Insects in Seychelles.—MS. received from the Colonial Office on 6th September 1919.

In consequence of the continued depredations of *Oryctes rhinoceros* (rhinoceros beetle) a bill has been prepared giving power to the Agricultural Department to eradicate the beetle at the expense of the owner from plantations that are not properly looked after, and also to deal with accumulations of rubbish in which the beetle breeds. *Technomyrmex albipes*, the small black ant that has been a very troublesome household pest in the low country at Mahé for the past ten years, has gradually disappeared, perhaps owing to the gradual reduction in the numbers of scale-insects, *Coccus* (*Lecanium*) *viridis*, *Eucalymnatus* (*L.*) *tessellatus*, *Ceroplastes rubens*, etc., which have been largely controlled by the fungus, *Cephalosporium lecanii*, introduced from Ceylon in 1911. This fungus, has spread all over the colony in a short time; its spread is dependent upon rainfall, the spores being more actively disseminated during the rainy season. It is proposed to introduce from South India another fungus, *Empusa lecanii*, which destroys the green scales even during cold weather. Spraying should be continued against the scae-insects that still remain in sufficient numbers to cause a fresh outbreak of infestation if dry weather should prevail for a long time. In the Praslin group of islands the fungus disease has not succeeded in controlling the scale-insects, which are causing severe damage, but the new species will be tried in these localities.

Among the insects identified during the year are *Argyroploce aprobola*, Meyr., a moth that oviposits on leaves of *Hibiscus abelmoschus* and greatly interferes with the culture of this plant except in places where the soil is so rich that its growth is vigorous enough to outgrow the attacks. The caterpillars may be killed by spraying every fortnight with lead arsenate. The Gracilariid, *Acrocercops angelica*, Meyr., was found in the Praslin islands attacking leaves of *Calophyllum inophyllum*, *Sideroxylon attenuatum* and other plants. As many as 50 eggs may be laid on one leaf, and as the caterpillars eat out large holes in them the trees become rapidly defoliated. This moth is indigenous and is giving considerable trouble

at Felicite Island; wet weather towards the end of the year considerably reduced its numbers. The Cerambycid, *Macrotoma wrighti*, was taken from a cedar tree on Praslin, where it has developed to such an extent as to have become a pest. *Stromatium barbatum*, F., another beetle of the same family, has been found attacking furniture. The larvae bore into all sorts of wood, including rose-wood, teak, etc.

Many Coccids occurred, including *Aspidiotus trilobitiformis* on *Passiflora foetida* and *Anacardium occidentale*; *Pulvinaria antigoni* and *Asterolecanium pustulans* var. *seychellarum* on *Lantana*; *Pinnaspis buxi*, Bch., *P. buxi* var. *alba*, Ckll., and *Poliaspis* sp. on leaves of areca nut palm (*Areca catechu*); and *Ceroplastes rubens*, Mask., on *Acrostichum aureum*.

Morice (F. D.). *Lygaeonematus wesmaeli*, **Tischb., a hitherto unrecorded British Sawfly (from Yorkshire).**—*Entomologists' Mthly. Mag., London,* September 1919, pp. 204–206.

Attention is drawn to the occurrence of the larch sawfly, *Lygaeonematus wesmaeli*, Tischb., on young larch trees in Yorkshire. It has so far only been recorded from Germany and Holland where it is considered a rare species.

Bodkin (G. E.). **Notes on the Coleoptera of British Guiana.**—*Entomologists' Mthly. Mag., London,* September 1919, pp. 210–216.

This list includes the Histerid, *Lioderma quadridentatum*, F., predaceous on other insects, especially the larvae of the sugar-cane borer, *Diatraea saccharalis*, F.; the Coccinellids, *Megilla maculata*, De G., predaceous on larvae of *Laphygma frugiperda*, S. & A. (rice-caterpillar); *Hyperaspis festiva*, Muls., on *Pseudococcus sacchari*, Ckll., which is also attacked by *H. octopustulata*, F., and *H. trilineata*, Muls.; *Azya trinitatis*, Mshl., and *Neda dilychnis*, Muls., on *Aspidiotus destructor*, Sign.; *A. pontbrianti*, Muls., on *Saissetia hemisphaerica*, Targ.; *Cryptognatha nodiceps*, Mshl., on *Aspidiotus destructor*, Sign., and the early stages of *Aleurodicus cocois*, Curt.; and *Pentilia insidiosa*, Muls., on *Asterolecanium bambusae*, Bdv., and *Pseudococcus citri*, Risso.

The Dynastid beetle, *Strategus aloeus*, F., is a pest of young coconut palms. The adults bore into the soil near the root, which they gradually destroy, and also attack the heart of the palm itself. The larvae are found in small colonies in decaying stumps of trees. *Ligyrus ebenus*, De G., is occasionally found in stems of full-grown sugar-cane. *Dyscinetus bidentatus*, Burm., of which the adult beetles bore into the stems of sugar-cane is a serious pest. As many as 38,000 beetles have been collected by one gang on one estate in a single year. The life-history occupies about 100 days. The eggs are laid in the earth at a depth of about 2 to 5 or 6 inches, near the cane stools. The duration of the larval stage is not known, but probably covers several months.

FROGGATT (W. W.). **Insects and St. John's Wort.**—*Agric. Gaz. N.S.W., Sydney*, xxx, no. 7, 2nd July 1919, pp. 470–472, 6 figs.

The recently discovered native scale-insect attacking St. John's wort, here described as *Icerya hyperici*, sp. n., should prove to be an effective agent in destroying this weed. The larvae are reproduced in hundreds, and the Coccid lives on the roots under the shelter of the soil.

FROGGATT (W. W.). **The White Grub or Grass Root Beetle** (*Scitala pruinosa*, **Dalm.**).—*Agric. Gaz. N.S.W., Sydney*, xxx, no. 7, 2nd July 1919, pp. 505–508, 2 figs.

The white grub, *Scitala pruinosa*, Dalm., is very destructive to grass plots in New South Wales. The chief damage is caused by the larvae attacking the roots. The beetles congregate on the foliage of small trees, where they might be poisoned and trapped before they burrow in the earth for oviposition. Natural enemies include birds, of which starlings are the most effective. The spread of the beetles to non-infested areas may be prevented by sinking hardwood boards into the soil to prevent migration of the grubs. If at all possible, the land should be turned over at the first appearance of the pest, this being a sure method of eradication. Where this is not practicable, a long-toothed rake might be drawn through the soil and the grubs collected.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu*, xvi, no. 7. July 1919, pp. 183–184.

The pests intercepted during the month of June included purple scale [*Lepidosaphes beckii*] on orange plants from the United States.

L'Arboriculture fruitière dans le Nord de l'Afrique. Cerisier.—*Rev. Hortic. de l'Algérie, Algiers*, xxiii, nos. 6–7, June-July 1919, pp. 261–273.

Cherry trees in Algeria are attacked by practically the same pests as those injuring plums. The most important of these is the Buprestid, *Capnodis tenebrionis*, L. (*tenebrioides*, Pall.) frequently occurring on wild pears. The eggs of this beetle are laid at the base of the trunks and the larvae descend to the roots, where they often cause the death of the tree. The adults should be destroyed when possible, but the best remedy is to protect the trunks by a coating of lime mixed with sulphur, arsenic and copper sulphate, bearing in mind that oviposition begins in May. An affected tree can sometimes be saved by collecting and destroying the larvae. Injections of carbon bisulphide are suggested as for *Phylloxera*, or calcium carbide might be tried, a small quantity being placed at the level of the deepest roots, and watered if the weather is dry. In many of the coast localities this Buprestid is the principal obstacle to the cultivation of plum-trees.

The plum Scolytid [*? Scolytus pruni*] is also a pest of peaches and cherries. Oviposition occurs in the spring in tunnels in the bark

and the larvae mine in the cambium, causing an exudation of gum. Sickly trees are most usually attacked, and these should be taken up and burnt. Healthy trees should be protected by a coating of lime on the trunks and main branches.

POUTIERS (R.). **Le Teigne de la Pomme de Terre.**—*Rev. Hortic. de l'Algérie, Algiers,* xxiii, nos. 6–7, June-July 1919, pp. 285–287.

Phthorimaea operculella (potato tuber moth) has recently been found to occur in a very limited area in the Department of Var (France), where it principally attacks stored potatoes. It has, however, also been found on the plants, as well as on other Solanaceae, such as tomatoes, nightshade, egg-plant, pimento, tobacco, etc. A general account is given of the habits of the moth and the known methods of control. As fumigation is not always feasible, it is hoped to establish colonies of a small Braconid, which is a parasite of *P. operculella* in the United States, as a natural means of control.

PAILLOT (A.). **La Karyokynétose, nouvelle Réaction d'Immunité naturelle observée chez les Chenilles de Macrolépidoptères.**—*C. R. hebdom., Acad. Sci., Paris,* clxix, no. 8, 25th August 1919, pp. 396–398.

Further experiments with *Bacillus melolonthae nonliquefaciens* on caterpillars of *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*) and *Lymantria dispar* are described [see this *Review*, Ser. A, vi, p. 134 & vii, p. 217]. These moths appear to be immune to this infection. The resulting cellular reaction is described. *Bacillus liparis* and *B. hoplosternus* give rise to similar conditions.

MOREIRA (C.). **Les Pucerons et leur Oeuf d'Hiver. (Hem. Aphididae).** [Aphids and their Winter Eggs.]—*Bull. Soc. Entom. France, Paris,* 1919, no. 13, 9th July 1919, pp. 236–238.

It has been known for many years that Aphids lay winter-eggs in order to ensure the maintenance of the species in climates where the winters are severe. When individuals of *Aphis rosae* were kept for four years in a warm room during winter and out of doors in summer, parthenogenetic, viviparous reproduction was continuous; while others, kept out of doors and without shelter produced, at the approach of winter, sexual individuals that mated and deposited winter-eggs. It was therefore concluded that in regions where there is no severe weather Aphids would not produce sexual individuals or winter-eggs. The author's observations on *A. nerii*, Boy. (*lutescens*, Mon.), carried out during four years in Rio de Janeiro, where it lives on *Asclepias currassavica* and on *Nerium oleander*, have demonstrated that the reproduction of this species is always parthenogenetic and less lengthy observations on other Aphids have confirmed this. When the number of Aphids on *A. currassavica* is sufficient to cover all the branches and leaves, so that the plant dies and the food fails, while at the same time the attacks of insect enemies begin, the winged forms begin to appear and fly or are blown to another

food-plant. The winged parthenogenetic individual alighting on either food-plant can give rise to winged individuals and later to apterous ones that form a new colony, as many as 1,600 individuals being produced within twenty days after its arrival.

The enemies attacking these Aphids include a Syrphid, *Baccha clavata*, one larva of which devours about ten Aphids daily. The life-cycle of this fly occupies 18 to 20 days. The larvae of the Coccinellid, *Neda sanguinea*, are also predaceous upon Aphids. The most important insect enemy is a Braconid, *Aphidius testaceipes*, the female of which deposits nearly 100 eggs and may parasitise as many as 20 Aphids. This parasite causes such depredations among Aphids that the appearance of winged forms soon becomes necessary for the continuation of the species.

PICARD (F.). **Description d'un Cynipide aphidiphage nouveau (*Alloxysta kiefferi*, sp. n.), Parasite du Puceron de la Betterave.**—*Bull. Soc. Entom. France, Paris*, 1919, no. 13, 9th July 1919, pp. 238-240.

While studying the parasites of *Aphis rumicis* (*euonymi*) (beet aphis), the winter-eggs of which are laid on spindle-wood (*Euonymus* spp.), the author discovered a new parasitic Cynipid taken at Montpellier, which is described under the name, *Alloxysta kiefferi*, sp. n. The female only has been found, although in the case of other species of this genus males appear to predominate. All the individuals found were taken within a few days at the end of May and beginning of June. At the same time a Braconid of the genus *Trioxys*, allied to *T. heraclei*, Hal., was found in great abundance, and also a predaceous Chalcid, *Asaphes* (*Isocratus*) *vulgaris*, Wlk.

The inter-relations of these various Hymenoptera are not definitely known. Many authors have considered the Cynipids to be true primary parasites of the Aphids; others consider them to be hyperparasites. A third hypothesis, that of hyperparasitism by the Braconids at the expense of the Cynipids, is hardly tenable in view of the fact that the Braconid parasite of a given Aphid is always more abundant than the Cynipid. The truth can only be discovered by the study in captivity of Aphids reared from eggs, and this is rather a difficult matter. *Asaphes vulgaris* has also been considered to be a hyperparasite, but there is no definite proof of this.

DUBOIS (P.). **Contre le Puceron lanigère du Pommier.**—*La Vie Agric. et Rur., Paris*, xv, no. 37, 13th September 1919, pp. 197-198.

Besides the usual petroleum emulsion against woolly aphis of apple [*Eriosoma lanigerum*] successful results have been obtained by spraying all crevices and cavities of the trunk and branches with 5 oz. of sodium sulphoricinate and 35 oz. of soft soap dissolved in 5 pints of rain water in the autumn, and watering the roots with ⅔ oz. of potassium carbonate dissolved in 5 pints of water to which have been added 3 oz. of sodium sulphoricinate, 2 oz. of methylated spirit and 1 oz. of titrated nicotine (2 oz. to 1 pint). This may also be applied in the spring as a spray.

GODET (C.). **Rapport sur l'Activité de la Station d'Essais viticoles à Auvernier, Année 1917-1918.**—*Annuaire Agric. Suisse, Berne,* xx, no. 1, 1919, pp. 1–55, 4 figs.

The relatively slight injury caused by *Clysia ambiguella* to vines during the year under review may possibly be attributed to climatic conditions, the very dry summer doubtless affecting the development of the caterpillars of the second generation. Parasites were also very numerous during the year. Experiments with various insecticides were continued and confirm previous observations [see this *Review*, Ser. A, vii, p. 46]. The sprays were applied by means of a revolving jet which proved very much more efficacious than the ordinary one. At light-traps a great number of *Sparganothis pilleriana* (*Pyralis vitana*) were caught, as well as *C. ambiguella.* Although no damage has been so far recorded in Switzerland by this moth, it may prove a serious pest at any time and its occurrence should therefore be guarded against.

LEEFMANS (S.). **Een uitheemsch Gevaar voor de Oliepalmcultuur (de Palmpitboorder); eene Waarschuwing voor de Planters.** [The Palm Kernel Borer, a foreign Insect dangerous to Oil Palm Cultivation in Java: A Warning to Planters.]—*Meded. Lab. voor Plantenziekten, Buitenzorg,* no. 37, 1919, 8 pp, 1 plate. [Received 18th September 1919.]

Mites, *Xyleborus coffeae*, a Forficulid and Bruchid beetles of the genus *Pachymerus* have been found in a parcel of seed from British Guiana. The Bruchid is considered to be *Pachymerus nucleorum* or a closely allied species. All stages were found in the seed of the oil palms, *Attalea spectabilis* and *A. cohune*. The mites and *Xyleborus coffeae* were found in the seed of *Thrinax parviflora* and *Borassus flabelliformis*. All these pests were killed by fumigating for 24 hours with carbon bisulphide, about 5¼ oz. per 36 cub. feet. Of a total of 25 palm nuts, 24 were attacked by the Bruchid, and as 17 of the infested nuts looked quite sound externally, it is obvious that the importation of seed is likely to be dangerous, and all parcels should be submitted by the receiver to expert examination before opening.

O Gurgulho da Batata doce. [The Sweet Potato Weevil.]—*Chacaras e Quintaes, S. Paulo,* xx, no. 2, 15th August 1919, pp. 100–101, 3 figs.

The weevil, *Euscepes batatae,* Waterh., appears to be the only pest of sweet potatoes known in Brazil. An appeal is made to growers to send in for identification specimens of any Coleoptera that may be found attacking these tubers. In the case of *E. batatae* a knowledge of the Brazilian States where it occurs would enable the others to establish quarantine measures against it.

DA COSTA LIMA (A.). **Principaes Caracteres differenciaes entre a Lagarta rosea da *Pectinophora gossypiella*, Saunders, e a falsa Lagarta rosea do *Pyroderces rileyi*, Walsingham.** [The Principal Characters differentiating the Pink Bollworm (*Pectinophora gossypiella*) from the False Pink Bollworm (*Pyroderces rileyi*.)]—*Chacaras e Quintaes, S. Paulo,* xx, no. 2, 15th August 1919, pp. 102–103, 1 fig.

The title of this paper fully indicates its contents, the author being the chief of the organisation dealing with the pink bollworm in Brazil.

ASHCROFT (R. W.). **Allotment Pests.**—*S. E. Nat., London*, 1918, pp. 73-87. [Received 12th September 1919.]

This paper intended as a guide to allotment holders gives a brief and popular account of the life-history of, and remedial measures for the pests most likely to occur. These include the bean aphis, *Aphis rumicis*; wireworms such as *Agriotes lineatus*, *A. obscurus* and *Athous haemorrhoidalis*; *Tipula oleracea*; *Pieris brassicae*, *P. rapae* and *P. napi*; the turnip flea-beetle, *Phyllotreta* (*Haltica*) *nemorum*; the cabbage-root fly, *Phorbia* (*Chortophila*) *brassicae*; the carrot fly, *Psila rosae*; and the onion fly, *Hylemia antiqua* (*Phorbia cepetorum*).

MARSHALL (G. A. K.). **Some new Injurious Weevils from Asia.**—*Bull. Entom. Research, London*, ix, no. 4, July 1919, pp. 273-277, 1 plate.

The new species described are *Antinia theivora*, taken in Java feeding on tea plants; *Dyscerus fletcheri*, from Assam at an elevation of 5,000 feet, where the weevils were boring into growing apple fruits, and from the United Provinces, where they were breeding in logs of *Pinus longifolia*; *D. malignus*, adults of which were observed puncturing apple fruits in Assam; and *Alcides mali*, from Assam at an elevation of 5,000 feet, boring into the shoots of apple trees. The latter species is closely allied to *A. ludificator*, which attacks teak in Burma.

GOUGH (L. H.). **On the Effects produced by the Attacks of the Pink Bollworm on the Yield of Cotton Seed and Lint in Egypt.**—*Bull. Entom. Research, London*, ix, no. 4, July 1919, pp. 279-324, 1 plate, 26 tables.

A short summary is given of the known facts concerning the life-history of *Pectinophora* (*Gelechia*) *gossypiella*, particularly as regards Egypt, the food-plants, distribution and habits being briefly discussed, also the rate of increase of the pest since its first appearance in Egypt in 1911. The rest of the paper explains the nature of the damage to cotton, as far as has been ascertained up to the present, and examines the possibility of estimating its extent. No attempt is made to show the damage to the quality of the lint or seed; only the total quantities lost have been traced. The calculations for estimating the loss of crop, which are described and illustrated by tables, include an examination into the weight of sound seed from attacked bolls, from which it is found that the average weight of seeds falls steadily as the percentage of infestation rises; the germination of sound seed from attacked bolls, which is indirectly affected by *P. gossypiella*; the number of seeds, sound or attacked, that develop in attacked bolls; the effect of infestation on the amount of lint produced, and an estimation of the damage done. It does not appear that the percentage of lint is greatly altered on account of the attack. Damaged seeds seem to produce lint on an average in the same proportion to their remaining seed weight as sound seeds from the same samples do. The damage done to attacked seeds

is only about one-half or less of the total damage, and this is often equalled, and sometimes exceeded, by the loss caused by the diminution of weight of the sound seeds or the non-development of other seeds. In the samples examined the average damage done has been roughly proportionate to the percentage of bolls attacked, the loss being somewhere about one-fifth of the total amount that could have been produced by the infested bolls. This would give about 20 per cent. loss if all the bolls in a sample were attacked. In an experimental field the damage done was between 11 and 16 per cent. of the first picking and between 17 and 20 per cent. of the second picking.

Since the appearance of *P. gossypiella* it is noticeable that *Earias insulana* (spiny bollworm) has almost disappeared as a major pest, probably owing to legislation that has made conditions unfavourable to its development. The bolls that were previously attacked by it were destroyed to a much greater extent than those now infested by *P. gossypiella*. It is true that the latter pest has compelled earlier cleaning up of the fields and has nearly done away with the possibility of a third picking. This however was bound to follow the introduction of early maturing varieties, which was necessitated owing to former bollworm attacks being chiefly on the second and third picking. The presence of *P. gossypiella* has accentuated this demand, and if a still earlier maturing cotton can be developed, it will compete advantageously with all later maturing varieties.

From observations made in 1917–1918 the rate of increase of *P. gossypiella* is shown for the various provinces. An attempt has been made to solve the problem whether resting larvae feed. From a table showing successive weighings of hibernating larvae a decided loss in weight is noticeable; this does not necessarily prove that the larvae were fasting, but lends a measure of probability to the theory that they do so.

An examination of seed stores in Alexandria showed very few moths flying in the day-time, though many were found hidden in dark crevices. In a trapping experiment in a store a 25-candle-power electric lamp was suspended about 6 in. above a basin of water with a small quantity of paraffin oil on the surface. The fact that 54,000 moths were thus caught by trap-lights during the year sufficiently disproves the statements that have been made that the adults are not attracted to light. The largest numbers were taken in September, October and November, while from December to April very few were observed.

The results of treating the seed by heat have been observed in six ginneries in Upper Egypt, and the germination records of seed so treated are shown in a table. In view of the perfect results obtained with seed treated at 150° to 157° F. as to germination and more especially as to the greater safety in worm killing, it is considered advisable in future for ginners employing heat treatment to work their machines for temperatures of 140° to 150° F. rather than for 132° to 140° F. The undesirability of exporting large quantities of treated seed to countries where *P. gossypiella* is not yet established is commented upon. Such cotton ought to be exported in small quantities only and consigned in such a way that subsequent re-infestation of the seed is made impossible. For instance, properly fumigated postal samples

are probably quite safe, as are larger quantities if sealed in tin boxes, but the danger of re-infestation after treatment is too great in the case of very large consignments.

BODKIN (G. E.). **An Invasion of British Guiana by Locusts in 1917.**
CLEARE (L. D.). **With a complete Illustrated Account of the Life-history of the Species.**—*Bull. Entom. Research, London*, ix, no. 4, July 1919, pp. 341–357, 8 figs.

An account of the invasion of locusts in British Guiana from Venezuela in 1917 has already been noticed [see this *Review*, Ser. A, vi, p. 335]. The species in question has not been definitely determined. In appearance the locusts were similar to specimens of migratory locusts that visited Trinidad and were identified as *Schistocerca paranensis*. Specimens from British Guiana were however identified in London as *S. vicaria*, Wlk., and in the United Stated as *S. americana*, Drury. It is thought that the darker individuals agree with *S. piceifrons*, Wlk., and that the type of *S. vicaria* may be merely a pale form of that species. *S. piceifrons* may be only a northern representative of *S. paranensis* but presents some constant differences.

A sketch-map shows the area on the north-west coast infested by the swarm. A full account is given of the life-history of the insects, with a description of the various stages. The campaign of 1917 proved that the previously described mechanical methods of control [*loc. cit.*], combined with a judicious administration of the Plant Diseases and Pests (Prevention) Ordinance, were adequate to deal with such an invasion. Tarpaulin sheets smeared with molasses, when used under favourable conditions, gave better results than any other method. The destruction of eggs, when practised on a large scale, gave excellent results, but was not widely utilised, as farmers had scarcely begun to realise the gravity of the situation before the eggs had already hatched. A little experience was necessary to discover the likely spots for the deposition of eggs; when they were located it was only necessary to fork up the soil to the depth of a few inches to secure the egg-masses. A figure is given of *Scelio venezuelensis*, Marsh., a parasite of the eggs of *Schistocerca*.

Entomology.—*Arkansas Univ. Agric. Expt. Sta., Fayetteville*, Bull. no. 158, December 1918, pp. 45–49. [Received 12th September 1919.]

The work of the year included experiments to prevent the round-headed apple-tree borer [*Saperda candida*] from depositing eggs in the trees, for which purpose a mixture of asphaltum and raw linseed oil was found to be the most successful. Worming the trees in August and April and spraying so as to poison the adults are also recommended.

Experiments were also carried out against the peach-tree borer [*Aegeria exitiosa*] [see this *Review*, Ser. A, vi, p. 448] and the woolly aphis [*Eriosoma lanigerum*] in the Ozarks [*loc. cit.*, p. 311].

Further investigations are being made with regard to the lesser apple worm [*Enarmonia prunivora*], codling moth [*Cydia pomonella*] and other apple pests. Damage to crops reported in July was probably due to the fall army worm [*Laphygma frugiperda*] or the grass worm; the latter was seriously injurious to rice. A serious outbreak of

wireworms occurred in July. The cotton boll weevil [*Anthonomus grandis*] was present in great numbers. In certain localities sowings of wheat made prior to 7th October were infested with the Hessian fly [*Mayetiola destructor*].

McSwiney (J.). **Report of the Agricultural Department, Assam, for the Period from 1st July 1918 to 31st March 1919**, *Shillong*, 1919, pp. 6–8. [Received 12th September 1919.]

Rice was attacked by *Hispa armigera* (rice Hispid); *Schoenobius incertellus* (*bipunctifer*) (rice-stem borer); *Leptocorisa varicornis* (rice bug), which was checked by bagging; *Spodoptera mauritia* and *Prodenia* sp. (swarming caterpillars) and *Cirphis* sp. (army worm), the former being controlled by means of nets dragged over the field, the latter by dragging ropes over the crops and trapping with heaps of grass. Another moth, *Nymphula depunctalis*, was dealt with by dragging ropes across the field, the water having been covered with a thin layer of kerosene oil, or where convenient, run off altogether. The removal and burning of infested patches was recommended for the scale, *Ripersia sacchari*. The mustard sawfly, *Athalia proxima*, was checked by dusting the plants whilst still wet with dew with a mixture of powdered soil and lime sprinkled with kerosene oil. *Diatraea* sp. is still active among sugar-cane, and the Arctiid moth, *Diacrisia obliqua*, against which hand-picking of the egg-masses is recommended, caused severe damage to jute, which was also attacked by crickets. Potatoes and other vegetables were attacked by cut-worms and red ants. A Pentatomid bug, *Rhynchocoris* sp., caused much damage by sucking the juice of the green fruit of orange trees causing them to drop or the pulp to become hard and dry; the tree ants, *Oecophylla smaragdina*, were noticed preying on this pest, which was also caught by means of sticks coated with gum. A scale, *Monophlebus* sp., was greatly reduced on orange trees by clearing the base and immediate surroundings of the tree.

Zimmerley (H. H.). **Greenhouse Tomato Growing in Virginia.**—*Virginia Truck Expt. Sta., Norfolk*, Bull. 26, 1st January 1919, 23 pp., 2 figs.

Pests of tomatoes grown under glass include *Aleurodes vaporariorum* (greenhouse whitefly), which is found principally on the under-side of the leaves. A combined fumigation of tobacco and hydrocyanic acid gas has given satisfactory results against it.

The Nematode, *Heterodera radicicola*, enters the roots and causes the formation of galls, resulting in weak, stunted growth and even death of the plant. Soil sterilisation by means of steam is the only remedial measure known.

Smith (L. B.). **The Life History and Biology of the Pink and Green Aphid (*Macrosiphum solanifolii*, Ashmead).**—*Virginia Truck Expt. Sta., Norfolk*, Bull. 27, 1st April 1919, 79 pp., 11 figs. [Received 12th September 1919.]

A detailed account is given of the life-history of and methods of dealing with *Macrosiphum solanifolii*, Ashm. [see this *Review*, Ser. A, iv, p. 133 and vi, p. 455].

A fungus, *Empusa aphidis*, is one of its most important natural enemies, and a Braconid, *Aphidius* (*Diaeretus*) *rapae*, Curt., has occasionally been reared from it in June.

The damage caused to various plants including potatoes, egg-plants, tomatoes and spinach, is described, and a list of 60 other plants on which this Aphid will feed is given. In addition to the direct injury to spinach, which is usually attacked during the autumn and winter months, this pest is responsible for the transmission of spinach blight.

In Norfolk this species apparently passes the year as a viviparous female and does not produce true sexes. Migration from the winter food-plants begins about March and the general migration ceases about 1st May. Intermittent migration to various weeds occurs in the autumn, lasting until about 15th November, but the majority of individuals settle on spinach. One variety of this plant from Manchuria is only attacked when other food is scarce. Experimentally an average of 13½ generations was produced between 1st May and 20th November 1915. The maximum number of young produced during the life of one female was 87, with an average of 43·3 in 1915 and 46·7 in 1916, the average life of a female for those years being 29·2 and 32·6 days.

OSBORN (H.). **The Meadow Plant Bug.**—*Maine Agric. Expt. Sta., Orono*, Bull. 276, March 1919, 16 pp., 7 figs. [Received 12th September 1919.]

The bulk of the information contained in this bulletin on *Miris dolabratus*, L., has been noticed elsewhere [see this *Review*, Ser. A, vii, p. 77.]

Seventh Annual Report of the Bureau of Agriculture. Pest Control Section.—*Philippine Agric. Review, Manila*, xii, no. 2, 1919, pp. 84–95, 8 plates, 1 fig. [Received 13th September 1919.]

This paper forms part of the report for the year ended December 1917. The Islands are now quite free of locusts.

The chief coconut pests are the rhinoceros beetle, *Oryctes rhinoceros*, and the palm weevils, *Rhynchophorus pascha* and *R. ferrugineus*. The Limacodid, *Thosea cinereomarginata*, was reported as defoliating plants, but *Aleurodicus cocois destructor* (coconut whitefly) has apparently entirely disappeared. Further investigations are being made with regard to the rôle of insects in the distribution of bud-rot [see this *Review*, Ser. A, vi, p. 24]. In connection with control measures for the cigarette beetle, *Lasioderma serricorne*, the amount of cigars treated during the year under review exceeds by over 100 per cent. that in any previous year. It is considered advisable that the Government should make the treatment of all cigars for export compulsory.

Experiments to control the rice bug, *Leptocorisa varicornis*, show that these insects are greatly attracted by the odour of putrid meat, and this, if saturated with a 3 per cent. solution of sodium arsenate and hung in bags at intervals in the fields, has proved to be a successful poison-bait. The best time for placing the bait has not yet been decided.

Pests collected on *Citrus* include a hitherto unreported Aleurodid closely resembling *Aleurodes citri*, with which it may prove to be identical.

BALL (E. D.) & FRACKER (S. B.). **Division of Entomology.**—*Bienn. Rept. Wisconsin Dept. Agric. 1917–1918, Madison*, Bull. 20, 31st December 1918, pp. 37–39 & 60–66. [Received 15th September 1919.]

The most serious pest of the year, the poplar weevil, *Cryptorrhynchus lapathi*, was successfully controlled by the application of "carbolineum Avenarius" which is sold under the name of Protexol. The variety known as "Vogel's poplar" is still apparently immune to atttacks by this pest.

The pests intercepted during the years under review included: Aphids on *Viburnum*; *Aspidiotus rapax* (greedy scale) on apple from France; *Gracilaria zachrysa*, Meyr., on *Azalea*; an egg-mass of *Malacosoma* sp. (tent caterpillar) on *Crataegus*; and eggs and cocoons of *Orgyia* (*Notolophus*) *antiqua* (vapourer moth) on *Spiraea* and *Azalea*.

The use of lime-sulphur against the San José scale has been abandoned, especially in towns and near houses, in favour of a mixture of 1 U.S. gal. of best miscible oil to 12 U.S. gals. of water. This mixture appears to be completely effective and does not discolour white paint like lime-sulphur.

PARROTT (P. J.), HODGKISS (H. E.) & HARTZELL (F. Z.). **The Rosy Aphis in relation to abnormal Apple Structures.**—*New York Agric. Expt. Sta., Geneva*, Tech. Bull. 66, January 1919, 29 pp., 8 plates, 6 figs. [Received 15th September 1919.]

The effects of attacks by *Aphis sorbi*, Kalt. (rosy aphis) on the development and conformation of apples are described in detail. The eggs of this aphis hatch during the period of swelling and breaking of the apple buds, and most of the nymphs have emerged by the time that the tips of the leaves have projected as much as one-fourth to half an inch from the ends of the more advanced buds. The nymphs crawl down among the young, tender leaves as they unfold, generally remaining about the leaves they first attack and not advancing to the tips of the shoots, as many allied species of Aphids do. Just about the time the pink colour begins to show in the unopened blossoms the Aphids of the first generation begin to mature and give rise to the second generation. At the time of dropping of the petals some individuals of the second generation reach maturity and enter on a period of reproductive activity. Although the first external evidences of injury are indicated by the curling of the leaves before blossoming, the greatest injury occurs with the maturing of the second and appearance of the third generation, when there is generally a marked invasion of leaf and fruit clusters around the primary centres of infestation. With the rapid multiplication of the insects the leaves that are most heavily infested become discoloured and may drop to the ground, while the vitality of the fruit spurs is weakened by loss of sap. The effect of a serious infestation is usually manifested by lower yields of fruit and sometimes the trees do not regain their normal condition until

several years have passed. Apples that have been subjected to attack by *A. sorbi* are usually checked in development, especially in the dimensions of the transverse diameter. The conformation and colour of the fruit is also affected.

The effects of Aphid infestation on the structure of apples, production of seed, weight, etc., are discussed at length with illustrations and tables, as well as their influence on the fibro-vascular system.

FULTON (B. B.). **Insect Injuries of Apple Fruit.**—*New York Agric. Expt. Sta., Geneva*, Circ. 57, 20th February 1918, 15 pp., 14 figs., 1 table. [Received 15th September 1919.]

This circular has been compiled for the purpose of helping fruit growers to distinguish the different kinds of insect injuries that appear on apple fruits at picking time. A key is given for the identification of such injuries, though it is pointed out that there are other insect injuries that are not apparent on the mature fruit, and a short account is given of the insects causing the damage. A spraying schedule for apples is given, with formulae for the usual sprays, including a dilution table for lime-sulphur wash, and a table showing the periods during which the various insects are actively injurious to the fruit, though this is not necessarily the proper time for combating them.

HARTZELL (F. Z.). **Experiments for the Control of the Grape Root-Worm.**—*New York Agric. Expt. Sta., Geneva*, Bull. 453, December 1918, pp. 255–332, 10 plates, 8 figs. [Received 15th September 1919.]

The life-history and habits of and damage caused by *Fidia viticida*, Walsh (grape root-worm) are described [see this *Review*, Ser. A, vi, p. 163]. Previous remedial measures against this pest aimed at the destruction of adults by arsenical sprays alone or in combination with Bordeaux mixture. This treatment, however, did not give very good results, and the present bulletin describes in detail tests made to determine its value, and also to develop a method of adding sweetened poison to make a more efficient insecticide. It was found that for general vineyard spraying, when the beetles are not abundant, two applications of Bordeaux mixture (8 : 8 : 100) with 6 lb. lead arsenate, at an interval of about ten days, were effective; but the treatment must be thoroughly done, at the proper moment, and in favourable weather, to ensure success, and is more effectual when continued over several seasons. When the beetles occur in excessive numbers, a more effective remedy is a spray of 2 gals. molasses, 6 lb. lead arsenate and 100 gals. water, followed in about a week by one application of the other mixture described. As the addition of molasses destroys the adhesiveness of lead arsenate [see this *Review*, Ser. A, vi, p. 198], the material must be applied at a time when no rain is expected for several days. Glucose proved less effective than molasses; zinc arsenite, either alone or with molasses, severely injured grape foliage. Testing of the flight of the adults of *F. viticida* showed that they usually fly with the wind, but do not migrate to any extent when the wind is strong.

Since 1912 there has been a steady decline in the numbers of the pest in vineyards in Chautauqua, and while all the factors causing this reduction are not known, it is believed that several species of Carabid beetles have exerted an important influence, the adults as well as the larvae being predaceous.

McIndoo (N. E.), Sievers (A. F.) & Abbott (W. S.). **Derris as an Insecticide.**—*Jl. Agric., Research, Washington, D.C.*, xvii, no. 5, 15th August 1919, pp. 177–200.

Experiments on the properties of derris as an insecticide are described. Though commonly known as *Derris* the correct botanical name of plants of this genus, which belongs to the Papilionaceae, is *Deguelia*. They are found throughout the tropics, but are more abundant in the Old World than in tropical America. These plants have long been known as fish poisons, for which purpose the roots are pounded into a pulp. Although derris may prove useful as a contact insecticide and as a stomach poison, it is of no value as a fumigant. As the material must be imported, only dried roots and stems are available.

Tests were made with petroleum ether, ether, chloroform, alcohol and water as solvents, and the results show that petroleum ether is a poor solvent, while the others may be considered good, though only alcohol and water can be regarded as economically useful, the best results being obtained with denatured alcohol.

Details are given of the experiments made with various species of *Deguelia*. Alcoholic extracts of *D. elliptica*, *D. uliginosa* and *D. koolgibberah* were generally efficient, while those of *D. oligosperma*, *D. scandens* and *D. robusta* were only seldom so; the powder of an unidentified species mixed with water or soap solution was usually efficient, while the other powders tested by this method were found ineffective; of 8 powders used as dusts, only *D. elliptica* and *D. uliginosa* and an unidentified species were found efficient.

Used as a powder derris was found to be equally effective against *Ctenocephalus canis*, Curt. (dog flea), Mallophaga on poultry, and *Musca domestica*, L. *Dermanyssus gallinae*, Redi (chicken mite) was killed in 24 hours when confined in jars, but under natural conditions all the mites were not killed. It is of very little value against *Cimex lectularius*, L. (bed-bugs), *Phyllodromia* (*Blattella*) *germanica*, L., *Pseudococcus citri*, Risso (mealy bug), *Orthezia insignis*, Doug., *Tetranychus telarius*, L. (*bimaculatus*, Harv.) (red spider) and the crawling young of the oyster-shell scale, *Lepidosaphes ulmi*, L., but was effective against *Aphis rumicis*, L. (bean aphis) and *Aphis pomi*, De G. (green apple aphis).

Used as a spray it proved effective against *Aphis pomi* under natural conditions. The sprays were applied with and without soap at strength varying from 1 lb. of powder in 25 gals. of water to 1 lb. of powder in 200 gals. of water. Even the weakest solution resulted in the death of 98–100 per cent. of the Aphids. The soap does not increase the effectiveness. Under greenhouse conditions it proved effective against *A. rumicis* at the rate of 1 lb. of powder to 400 gals. of water with the addition of soap at the rate of 1 lb. to 100 gals. of water.

Used as a stomach poison against *Leptinotarsa decemlineata*, Say (potato beetle) at strengths ranging from 1 lb. of powder to 16 gals. of water up to 1 lb. to 128 gals. it killed all larvae within 48 hours. Other insects against which it proved effective include *Malacosoma americana*, F. (tent caterpillar), *Hyphantria cunea*, Dru. (fall web-worm), *Anisota senatoria*, S. & A. (oak worm), *Datana ministra*, Dru., and *Phytometra (Autographa) brassicae*, Riley (cabbage looper). Some insects are more easily affected than others, but apparently death eventually occurs in all cases through motor paralysis. The toxic principle is probably a resin.

LEWIS (A. C.). **Annual Report of the State Entomologist for 1918.**—*Georgia State Bd. Entom., Atlanta*, Bull. 55, May 1919, 31 pp. 2 maps. [Received 16th September 1919.]

The damage caused by the cotton boll weevil [*Anthonomus grandis*] in Georgia during the year under review resulted in the reduction of the crop by as much as 50 per cent. in some counties. Maps are given showing the extent of the territory covered by this pest. Various experiments were made during the year to control the weevil by means of dusting with lead arsenate, calcium arsenate and Lazal, together with sulphur and lime in each case. The results obtained seem to indicate that late dustings are preferable to early ones, but more extensive experiments, for which plans have already been made, are needed to confirm these observations.

New pests recorded during the year included a species of *Margarodes* and the chrysanthemum midge (*Diarthronomyia hypogaea*) which was apparently introduced with chrysanthemums from Indiana.

Boll Weevil Quarantine Regulations.—*Georgia State Bd. Entom., Atlanta*, Circ. 25, January 1918, 11 pp., 1 map. [Received 16th September 1919.]

In 1917 the damage caused by the boll weevil [*Anthonomus grandis*] in Georgia amounted to from 25 per cent. to 75 per cent. of the crop. A map showing the infested area and the determination of the 20 mile safety line is given. The regulations governing transportation of cotton seed, seed cotton, hulls, seed cotton and cotton pickers' sacks, etc., directed against the spread of this pest are recapitulated and brought up to date [see this *Review*, Ser. A, iv, p. 435].

SPEYER (E. R.). **Report on the Work of the Entomological Division including Special Investigations into Shot-hole Borer of Tea.**—*Rept. Ceylon Dept. Agric., 1918*, 12th February 1919, pp. C. 11–12. [Received 12th September 1919.]

Owing to severe drought in January, tea pests, especially *Calotermes militaris* and various mites, appeared in great abundance; the latter were dealt with by spraying with lime-sulphur. The fluted scale [*Icerya purchasi*] was kept in check by the fungus *Cephalosporium*. Consignments of the Coccinellid enemy of this scale [*Novius cardinalis*] have been received, but have not yet become established. The experiments to deal with the rice pest, *Spodoptera mauritia*, with kerosene

failed, this moth being chiefly kept in check by crows. Experiments not yet completed show that petrol used in small quantities would be a very satisfactory fumigant for Bruchids and other beetles infesting grain.

Other pests were *Agrotis ypsilon* on vegetables and *Zeuzera coffeae* and *Xyleborus compactus* on tea.

Against shot-hole borer of tea [*Xyleborus fornicatus*] various insecticides were tested immediately after pruning, the most effective mixture being made of 10 lb. of Tennant's yellow bar soap, 5 lb. of resin and 1 gal. of fish-oil, used as a 30 per cent. solution.

JARDINE (N. K.). **Special Investigation into Tea Tortrix.**—*Rept. Ceylon Dept. Agric., 1918*, 12th February 1919, pp. C. 12-13.

The work on *Homona coffearia* has been continued, especially with regard to natural means of control. No egg-parasites have yet been found. Birds devour the caterpillars to some extent, but also destroy the larval parasites. Bats, lizards and mason wasps are of little or no value in controlling this moth. Endeavours to propagate polyhedral disease among healthy larvae have failed, and the organism does not appear to spread among them unless there is overcrowding and lack of food.

LOOS (K.). **Einige Beobachtungen, Versuche únd Untersuchungen über die Lebensweise der Tachine, *Parasetigena segregata*, Rdi., auf dem Libocher Herrschaftsgebiet.** [Some Observations, Experiments and Researches on the Life-History of the Tachinid, *Parasetigena segregata*, Rdi., in the Liboch Territory.]—*Vereinsschr. Forst-, Jagd- u. Naturkunde, Prague*, 1915–16. no. 12, pp. 537–563. [Received 9th September 1919.]

This is a full account of the author's investigations on *Parasetigena segregata*, Rond., a Tachinid parasite of the nun moth, *Porthetria* (*Lymantria*) *monacha*. The influence of dry, warm, sunny weather on this fly is very marked, and it is quite possible that oviposition may be temporarily suspended during continued cold, wet weather. In the warm year 1911 oviposition was at its height between 14th and 24th June, 50 per cent. of the host eggs being parasitised, whereas in the cold year 1909 oviposition only reached that height at the end of June and immediately decreased. Of 284 caterpillars collected on 24th June 1911 those harbouring Tachinid eggs amounted to 143, of which 93 contained one egg, 31 two eggs and 19 three eggs. Oviposition is usually effected in the crowns of the trees, this being the situation where *P. monacha* is chiefly found. As a general rule few caterpillars are found to be parasitised beneath the sticky bands in forests where banding is practised. Moreover, banding is usually done in forests that have been thinned, and thinning exposes the crowns to more light and renders them more attractive. The Tachinid eggs required about 6 days for development in 1911, though according to Escherich at least $8\frac{1}{2}$ days are necessary. Owing to the comparatively long development period of these Tachinid eggs, it occasionally happens that when the nun moth larvae moult some unhatched eggs are cast off with the skin and it is estimated that from

30 to 40 per cent. of the eggs are thus destroyed. The Tachinid larva requires 19–22 days to attain maturity. This slow development is due to the fact that *P. segregata* does not find in the small body of the host caterpillar a store of food sufficient for rapid growth. The Tachinid larva pupates 12–16 hours after emerging from its host. The infested caterpillar shows a decided tendency to pupate and seeks a suitable shelter for the purpose, so that the parasitic larvae in the last days of their development are protected against unfavourable conditions and natural enemies to the same extent as if in a host pupa. Caterpillars in which eggs have been laid early in the season seek a pupal shelter early but are unable to pupate, while those in which eggs have been deposited much later become apparently normal pupae, but at an earlier date than if they were uninfested. It is therefore a mistake to destroy the caterpillars that are ready to pupate early in the season on the lower parts of trees.

PRELL (H.). **Zur Biologie der Nonnentachine.** [Notes on the Biology of the Nun Moth Tachinid.]—*Vereinsschr. Forst-, Jagd- u. Naturkunde, Prague,* 1916–17, no. 3–4, pp. 168–178. [Received 9th September 1919.]

This paper contains further details on *Parasetigena segregata* and discusses the differences between the author's observations and those of Loos [see preceding paper]; such differences may be due to variation in the value attached to the temperature factor.

LOOS (K.). *Xyleborus saxeseni*, **Ratz.**—*Vereinsschr. Forst-, Jagd- u. Naturkunde, Prague,* 1917–1918, no. 10–12, pp. 372–377, 6 figs. [Received 9th September 1919.]

This article describes the mines of *Xyleborus xylographus*, Say (*saxeseni*, Ratz.), which—as found in an apple tree—present many differences from Eichoff's description of them.

SIAHAJA (E. L.). *Helopeltis*-**Bestrijding op de Onderneming Leuwimanggoe.** [Anti-*Helopeltis* Work on the Leuwimanggoe Estate.] —*Meded. Proefstation voor Thee, Buitenzorg,* lxiv, 1919, pp. 4–9. [Received 12th September 1919.]

From July to December 1918 experiments were made in capturing *Helopeltis* on an area of 88 acres in order to ascertain the extent to which infestation could be checked at a cost of 35*s.* per acre, this figure being based on the average price and average yield of leaf, and being one that would be remunerative and become more so as the price of tea increased. Both the direct and indirect loss due to *Helopeltis* was calculated. The average cost per acre per month was 4*s.* 3*d.*, and it should be noted that the six months chosen were those in which *Helopeltis* is most dangerous. On the 40 acres in which pruning was done earliest, the danger period was over by the end of December, in which month the cost was 3*s.* per acre, while on the remaining area the December cost was 6*s.* 7*d.* per acre

Up to January 1919, the total area was practically free from infestation and in better condition than others where *Helopeltis* was not collected.

VAN VLOTEN (O.). *Helopeltis*-**Bestrijding.** [Anti-*Helopeltis* Work.] —*Meded. Proefstation voor Thee, Buitenzorg*, lxiv, 1919, pp. 10–11. [Received 12th September 1919.]

The Tjigombong estate, which is situated in a *Helopeltis* belt, was kept practically free from infestation by systematic collection. The cost of searching for newly-started infestations and their immediate destruction worked out at from 1*s.* 6*d.* to 4*s.* per acre per month for the 1,575 acres. The view that *Helopeltis* increases rapidly was disproved and it was surprising how the pest was kept down. On another estate the adults were captured in tents [see this *Review*, Ser. A, vii, p. 31], and were seen to fly vertically upwards and to settle on the roof. As the adults fly away when pruning, which kills most of the larvae, is carried out, it is advisable to use the tents before this operation. Any surviving larvae must be looked for after pruning. A careful record of the captures and of the dates of infestation is necessary. Whenever the number of insects captured exceeds 15 per coolie per day this is a sign of danger and the workers must be reinforced.

CHAINE (J.). **La Forêt de la Mamora (Maroc) et la Processionaire du Chêne** (*Cnethocampa processionea*, **Dup.**).—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xviii, no. 7, July 1919, pp. 65–67.

Very serious damage by *Cnethocampa processionea*, Dup., was noticed in June 1918 in a large forest of cork oaks [*Quercus suber*] in Morocco. Wild pear trees in the immediate vicinity of the infested zone seemed entirely immune to attack. This moth frequently occurs in different regions, completely defoliating every tree attacked. The economic importance of such an outbreak may be judged from the fact that the forest in question covers an area of about 300,000 acres and supplies at least half of the total production of cork oak of Morocco.

LÉCAILLON (A.). **Sur la Biologie du Tigre du Poirier** (*Tingis piri*, **Geoffroy**).—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xviii, no. 7, July 1919, pp. 73–77.

In 1918 severe attacks of *Stephanitis* (*Tingis*) *pyri*, Geoffr., in orchards were reported from the department of Haute Garonne, pears and apples being equally attacked. The trees growing against walls are more liable to infestation than those exposed to the north or east. These bugs were found in abundance from the 19th May to 4th December. The injury is partly caused by the excrement deposited on the leaves and partly by the punctures made in sucking. Though only the leaves are attacked, the injury is often so severe in the south of France as to prevent the formation of fruit.

Pruning of affected leaves or stomach poisons are useless, the only possible remedy being the use of sprays that will kill the insect by simple contact or by fumigation with nicotine or hydrocyanic acid gas.

MOREAU (L.). **Les Traitements contra la Cochylis.**—*C.R. de l'Assemblée Gén. 1919, Bull. Soc. Agriculteurs France, Paris,* Supplément Bull. July 1919, pp. 129–137.

As very little progress has been made in the study of control measures against *Clysia ambiguella* and other vine pests during the war, the author reviews the work done in Anjou during the years 1907–1911 [see this *Review*, Ser. A, i, pp. 220, 337 and ii, pp. 16, 550, etc.].

BRÈTHES (J.). **Sección Entomología.**—*Mem. Trabajos realizados por el Inst. Biológico, Soc. Rural Argentina (May 1917 to 30th April 1919), Buenos Aires,* 1919, pp. 32–35. [Received 10th September 1919.]

The work of the entomological section for 1917–1919 is reviewed. This has chiefly taken the form of the study of the natural parasites of agricultural pests and their practical application in remedial measures. It is pointed out that several years' observation is necessary before the efficacy of various insect enemies can be accurately estimated, while another difficulty that exists in the Argentina and other South American countries is the lack of exact identification of many insects.

Many enquiries have also been dealt with concerning various pests, including *Eriophyes pyri,* Pgst., causing withering of pear-tree leaves; *Leucaspis pini,* Hart., on pines; *Dyscinetus gagates,* Burm., which attacks wheat at the ground level and totally destroys large areas; various caterpillars about which little is at present known under South American conditions, such as *Rachiplusia nu,* Gn.; various Aphids; *Aspidiotus (Aonidiella) perniciosus,* Comst. (San José scale); *Aulacaspis (Diaspis) pentagona*; *Pulvinaria platensis,* Brèth., *P. flavescens,* Brèth., and *P. minuta,* Brèth., on quince, *Eugenia,* lemons, etc., of which various natural enemies have been discovered; *Papilio thoas thoantiades,* Burm., on oranges; *Malacosoma (Clisiocampa) brissotti* on peaches; *Colias lesbia,* F., on lucerne; *Tatochila autodice,* H. S., on white cabbage; *Sitotroga cerealella,* Oliv., damaging wheat, maize, etc., both stored and in the field; and a Coccinellid, *Epilachna (Solanophila) paenulata,* Germ., which injures the leaves of melons and other Cucurbitaceae.

Particular attention has been given to the study of Hymenoptera. The results of many observations have already been noticed in this *Review,* but many years must elapse before even an approximate knowledge is reached of the parasitic fauna of Argentina.

MERRILL (G. B.). **Host List of the Fluted or Cottony Cushion Scale.**—*Qtrly. Bull. Florida State Plant Bd., Gainesville,* iii, no. 4, July 1919, pp. 125–133.

An extensive list of the food-plants of the cottony cushion scale, *Icerya purchasi,* Mask., is here given.

Bee Disease Eradication.—*Qtrly. Bull. Florida State Plant Bd., Gainesville,* iii, no. 4, July 1919, p. 136.

The bill providing for the prevention and eradication of diseases of honey bees in Florida has now became law. The State Plant Board is responsible for the execution of the law, and work for the eradication of American foul brood has already been undertaken.

RITCHIE (A. H.). **Annual Report of the Government Entomologist for 1918-1919.**—*Jamaica Dept. Agric. Ann. Rept. for Year ended 31st March 1919, Kingston,* 1919, pp. 26-30.

Sugar-cane cultivation was greatly interfered with and in certain districts proved a complete failure owing to the ravages of Elaterid grubs. As lengthy ratooning is the chief cause of insect trouble, resting the land or rotation of crops is advised as the best remedial measure, together with the burning of infested stools. If immediate replanting should be essential, all measures should be taken to ensure rapid establishment of the canes so as to resist wire-worm attacks. A serious outbreak of white grubs occurred, but their abundance depends on the weather and the humidity of the soil. During the autumn rains a large number of grubs were attacked by a fungus, *Isaria ritchiei.*

Two consignments of the Histerid beetle, *Plaesius javanus*, were imported from Java to combat the banana root weevil, *Cosmopolites sordidus*, Germ., but as most of the beetles died on the way further shipments will have to be made to ensure their establishment.

The coconut scale [*Aspidiotus destructor*] was prevalent during the year; lime-sulphur 1 part to 15 parts of water is advocated against it. An ant, *Cremastogaster brevispinosa*, was responsible for the colonising of mealy bugs on cacao, necessitating systematic gathering of the nests. Other pests included: *Saissetia hemisphaerica* on *Citrus*; *Aleurocanthus woglumi* (black-fly) on limes; a fruit-fly, *Anastrepha fraterculus*, Wied., on mangos; and *Pulvinaria pyriformis* on avocado pear. *Cajanus indicus* (pigeon pea) was severely damaged by *Macraspis tetradactyla*, which destroys the blossoms, the larvae of this beetle being found in decaying coconut stems. *C. indicus* was also attacked by *Hemichionaspis minor*, but this scale is seldom seen if the crop is treated as an annual.

Yams (*Dioscorea* sp.) were severely infested with a weevil, *Palaeopus costicollis*, Mshl. (*dioscoreae*, Pierce). The only preventive measure known is the careful selection of yam heads at planting time. All infested tubers should be destroyed when the crop is gathered. The treatment of young yam heads, prior to planting, with lime-sulphur against *Aspidiotus hartii*, Ckll. [see this *Review*, Ser. A, vii, p. 56] has proved most efficacious. Potatoes from Canada were infested with pupae of a *Drosophila*.

Other miscellaneous pests included an undetermined Scolytid attacking maize cobs in the field; *Peregrinus maidis* (corn leaf-hopper) attacking maize in large numbers; *Eudamus proteus* (bean leaf-roller) attacking Jerusalem peas (*Phaseolus mungo*, var. *radiatus*); and *Diaphania hyalinata* and *D. nitidalis* on cucumber and pumpkins. Flour was heavily infested with *Silvanus surinamensis* and *Tribolium confusum*.

FERNALD (H. T.). **Report of the Entomologist for 1918.**—*Massachusetts State Dept. Agric., Boston,* Department Circ. 3 (November 1918), 1919, 8 pp. [Received 23rd September 1919.]

The apparent decrease of injury by *Aspidiotus perniciosus*, Comst. (San José scale) was probably due to the severity of the winter, as the

parasite, *Prospaltella perniciosi*, Tower, is becoming less effective. *Pyrausta nubilalis*, Hb., is gradually spreading in the State, although several reports of injury attributed to this pest were on investigation found to be caused by *Papaipema nebris*, Gn. (*nitela*, Gn.).

Other insects recorded are: *Conotrachelus nenuphar*, Hbst. (plum curculio) causing severe damage to plums and apples; *Heterocordylus malinus*, Reut., and *Lygidea mendax*, Reut. (red bugs); *Macrodactylus subspinosus*, F. (rose chafer), which was unusually abundant on grapes, roses and other plants. *Galerucella luteola*, Mull. (elm-leaf beetle) and *Malacosoma americana*, F. (apple-tree tent-caterpillar) were almost absent during the year. *Diabrotica vittata*, F. (cucumber beetle) and *Leptinotarsa decemlineata*, Say (Colorado potato beetle) were very abundant, as well as *Lema trilineata*, Oliv. (three-lined potato beetle). *Macrosiphum solanifolii*, Ashm. (potato aphis) was extremely abundant and appeared about 10 days earlier than in the previous year, but had practically disappeared early in August. Beeches and maples were defoliated by *Heterocampa guttivitta*, Wlk., which in the absence of its natural food-plant will apparently attack any tree, including apples, except evergreens and moosewood (*Acer pennlyscanicum*); a Carabid beetle, *Calosoma frigidum*, Kirby, and a bug, *Podisus modestus*, Dall., were observed feeding on the caterpillars of this moth.

Anisota rubicunda, F. (striped maple worm) was very numerous, and *Pieris* (*Pontia*) *rapae*, L., was more abundant than usual in September, as also were the squash vine-borer, *Melittia satyriniformis*, Hb., and *Hyphantria cunea*, Dru. (fall web-worm) during August.

MASKEW (F.). **Reports for the Months of May and June 1919.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, viii, no. 7, July 1919, pp. 429–432.

Insect pests intercepted during May and June included: From Central America: *Aspidiotus cyanophylli* and *Icerya* sp., on bananas; *Pseudococcus* sp., on bananas and *Hibiscus*; *Ceroputo* sp., and an ant on orchids. From China: *Lepidosaphes gloveri*, *Parlatoria pergandei* and *Hemichionaspis aspidistrae* on pomelos; *Araecerus fasciculatus* in dried vegetables; *Cylas formicarius* in sweet potatoes; and Lepidopterous larvae in dry beans and dry roots. From Florida: *Lepidosaphes beckii* on grape-fruit. From Hawaii: Coleopterous larvae on silver sword; *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapples; and *Coccus longulus* on betel leaves. From Japan: *Lepidosaphes ficus* on pears; *Pseudococcus comstocki*, *Lecanium* sp., *Pulvinaria* sp. and *Eulecanium cerasorum* on wistaria; mites, *Thyridopteryx* sp. and Lepidopterous pupae on *Daphne*; larvae of borers in Japanese cherry; Coleopterous borers in dead twigs of *Acer* sp.; *Pseudococcus* sp., on *Retinospora obtusa* and pot plants; Lepidopterous larvae on cedars, *Euonymus* and *Retinospora obtusa*; larvae and pupae of Lepidoptera on nursery stock; undetermined Lepidoptera in rice straw used as packing; *Bruchus pisorum* in peas; *Parlatoria pergandei* var. *camelliae* on camellias; *Pseudaonidia duplex* on azaleas and camellias; Aphids and thrips on maple; an Aphid on juniper;

Lecanium sp. on *Nandina*; a flat-headed borer in *Photinia*; *Aspidiotus* sp. on pot-plants; *Thyridopteryx ephemeraeformis* on cedars; *Coccus hesperidum* on mokkoku shrubs; millipedes, Drosophilids and Lepidopterous pupae in packing. From Mexico: *Heliothis* (*Chloridea*) *obsoleta* in tomatoes; an undetermined weevil in beans; *Lepidosaphes gloveri*, *Chrysomphalus scutiformis* and *Parlatoria cinerea* on limes; *Carpophilus hemipterus* in dried bananas; *Chrysomphalus* sp. and an ant on orchids. From Ohio: *Aphis* on roses; *Lepidosaphes ulmi* on lilacs. From Oregon: *Epochra canadensis* in gooseberries. From Tahiti: *Chrysomphalus aurantii* on lemons. From Texas: *Calandra granaria* in sorghum grain; *Aleurodes* sp., on *Gardenia*. From Wisconsin: *Pseudococcus longispinus* on *Dracaena*. From England: *Pseudococcus* sp., on heather. From Illinois: *Tortrix* (*Archips*) *obsoletana*, *Aphis* sp., and a Dipterous pupa on roses. From Pennsylvania: *Saissetia oleae*, *S. hemisphaerica* and *Pseudococcus* sp., on crotons. From Belgium: *Coccus hesperidum* and *Aspidiotus britannicus* on bay trees.

SWAINE (J. M.). **A new Forest Insect Enemy of the White Birch.**—*Canadian Forestry Jl., Woodstock, Ont.*, xiv, no. 10, November 1918, pp. 1928–1929, 1 fig. [Received 22nd September 1919.]

Attention is drawn to the appearance in large numbers of the bronze beetle, *Agrilus anxius*, on white birch in the forests of Quebec. The bulk of the information given has been noticed elsewhere [see this *Review*, Ser. A, vi, p. 62].

MILLER (D.). **The Status of Entomology in the Economy of the Dominion.**—*N.Z. Jl. Sci. & Technol., Wellington*, ii, no. 4–5, July 1919, pp. 269–273, 1 fig. [Received 23rd September 1919.]

Comparison is made between the numbers of indigenous and exotic insect pests in New Zealand. Of the noxious fauna the indigenous species only amount to ·18 per cent., but unless precautionary measures are taken, this number is likely to increase owing to the insects changing their food-plant when their natural one has been destroyed. Very little is yet known of the destructive insects of New Zealand and special work is being undertaken to increase this knowledge with a view to publishing a comprehensive work dealing with the matter. General co-operation of the farming community is essential in order to carry out the undertaking successfully.

GOSSARD (H. A.). **Seventeen-Year Locusts due in Western Ohio. Appearance of Insects makes planting of New Trees dangerous.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, iv, no. 4, April 1919, pp. 124–128, 1 map.

A list is given of the counties in which the 1919 brood of the seventeen-year locusts [*Tibicen septemdecim*] are expected to be most prevalent in Ohio. A brief account is given of the life-history and habits [see this *Review*, Ser. A, v, p. 403] and the usual remedial measures are advocated [*loc. cit.*, pp. 328 and 369].

BLACKMAN (M. W.). **Notes on Forest Insects. 1. On two Bark-Beetles attacking the trunks of White Pine Trees.**—*Psyche, Boston, Mass.*, xxvi, no. 4, August 1919, pp. 85–96, 1 plate, 1 fig.

Ips longidens, Swaine, has been found in large numbers infesting white pine (*Pinus strobus*) in New York. It may be a primary or secondary pest, and is usually found in the middle region of trees measuring 4–8 inches in diameter. In larger trees it may be found higher up, the character of the bark being the factor determining the choice of position. Though the beetles usually attack diseased or dying trees, they may become the actual cause of death. The method of working, which is described, is similar to that of *Pityogenes hopkinsi*, Swaine [see this *Review*, Ser. A, iv, p. 234].

Ips longidens has been found associated in the same tree with *I. pini*, Say, *Pityogenes hopkinsi*, Swaine, *Crypturgus atomis*, Lec., *Graphisurus fasciatus*, De G., *Monochamus* (*Monohammus*) *scutellatus*, Say, *Dendroctonus valens*, Hopk., *Orthotomicus* (*Ips*) *caelatus*, Eich., *Dryocoetes americanus*, Hopk., *Hylastes* (*Hylurgops*) *pinifex*, Fitch, *Gnathotrichus materiarius*, Fitch, *Cossonus corticola*, Say, *Monochamus confusor*, Kirby, *M. titillator*, F., *Rhagium lineatum*, Oliv., and *Pytho americanus*, Kirby, occurring chiefly in the lower region of the trunk. *Pityophthorus granulatus*, Swaine, *Chrysobothris femorata*, F., *C. dentipes* Germ., and *Pogonochaerus mixtus*, Say, are occasionally associated with it in the tops and limbs. Predaceous beetles associated with *Ips longidens* include *Phylloboenus dislocatus*, Say, and *Hypophloeus tenuis*, Lec. A parasitic Hymenopteron, *Coelopisthus* sp., was taken from a pupal chamber.

Hylastes pinifex, Fitch, attacks white pines by preference, but is also recorded on spruce and Eastern larch. The burrows are usually in the lower part of the trunks and frequently in stumps of recently cut trees. They may extend to the main roots, 6 or 8 inches underground. The egg-gallery is a simple cylindrical mine extending longitudinally and the eggs are laid along the sides in niches or longitudinal grooves. The larval burrows are exceptionally long, measuring 10 to 12 inches. They commence at right angles to the egg-gallery but soon become tortuous. Pupation takes place in a carefully constructed pupation chamber in both bark and sapwood. The beetles emerge about a week after pupation has occurred. Normally there is only one generation a year in New York State, but if young adults that remain in their larval food-plants from the late summer until the following June are removed to another food-plant they immediately commence fresh burrows. Insects associated with *H. pinifex* include many of those mentioned above as well as *Ips calligraphus*, Germ., and *Ips longidens*, Say. *Glischrochilus sanguinolentus*, Oliv., and several unidentified Nitidulids and Staphylinids occur in the feeding burrows of the young adults.

ANSTEAD (D. R.). **The Coffee Planting Industry in Southern India.**—*Agric. Jl. India, Calcutta*, xiv, no. 4, July 1919, pp. 578–585. [Received 22nd September 1919.]

The history of coffee cultivation in Southern India is reviewed. The chief insect pests include the scales, *Coccus viridis* and *Coccus colemani*, owing to which coffee has had to be replaced by tea in

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certain districts. Where this was not possible, prompt spraying with fish-oil or resin soap was resorted to and the fungi, *Cephalosporium lecanii* and *Empusa lecanii*, were propagated in places where they did not already occur by tying up fungus-attacked scales in the trees. Ants, especially *Cremastogaster*, are largely responsible for the spread of these scales, for which reason their nests should be destroyed.

Pseudococcus (*Dactylopius*) *citri* was very destructive in the past to the roots of young plants, but is now successfully kept in check by a soil disinfectant consisting of naphthaline and crude carbolic acid.

KUNJAN PILLAI (N.). **Coconut: The Wealth of Travancore.**—*Agric. Jl. India, Calcutta*, xiv, no. 4, July 1919, pp. 608-628. [Received 22nd September 1919.]

This paper, dealing with the uses and possibilities of coconut cultivation, mentions the following pests as occurring in Travancore: *Oryctes rhinoceros* (rhinoceros beetle), *Rhynchophorus ferrugineus* (palm weevil) and a Limacodid moth, *Contheyla rotunda*, Hmps.

MADHVAN PILLAI (R.). **An Attack of *Nephantis serinopa* on Coconut Palm in Travancore.**—*Agric. Jl. India, Calcutta*, xiv, no. 4, July 1919, pp. 668–669, 2 plates. [Received 22nd September 1919.]

A Microlepidopteron, *Nephantis serinopa*, Meyr., is reported to have caused great injury to coconut palms in Travancore since the beginning of 1917, although the damage was not definitely attributed to it until May 1918. During that time about 9,000 palms have been attacked. The affected trees have a faded appearance and take about a year to recover their normal condition; if the injury is great, it not infrequently causes the death of the palm. The whole life-cycle is completed on the food-plant. The larvae mine the under-surface of the leaf and eat away the green tissue of the leaf blade. Pupation occurs in the damaged leaves. Larvae may be found at all times of the year.

Spraying with contact and stomach poisons is of value in the case of young trees, but cutting and burning the affected leaves is recommended as the best means of keeping the pest in check.

GIBSON (A.). **The Corn Ear-Worm in Consignments of imported Tomatoes.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 9, September 1919, pp. 797–799, 3 figs.

Attention is called to the fact that the corn ear-worm, *Heliothis obsoleta*, has been found in tomatoes imported into Canada from Tennessee.

BRITTAIN (W. H.). **An Infestation of Apple Sucker, *Psylla mali*, Schmidb., in Nova Scotia.**—*Agric. Gaz. Canada, Ottawa*, vi, no. 9, September 1919, pp. 823–827, 5 figs.

The apple sucker, *Psylla mali*, Schmidb., is recorded for the first time from Nova Scotia, and this is probably its first occurrence in

North America. Remedial measures advocated are spraying with nicotine sulphate as for *Aphis pomi* or *A. malifoliae*. Should a second application be necessary, it may be made just before the blossoms open so as also to be useful against the green apple bug, *Lygus communis* var. *novascotiensis*, Knight. Experiments were made with various dusts, which are apparently less efficacious than liquid sprays, but definite conclusions could not be obtained owing to the advanced development of insects and trees at the time of application.

European Corn Borer the most dangerous Pest to American Agriculture.—*Wkly. Press Bull., Pennsylvania Dept. Agric., Harrisburg*, iv, no. 37, 18th September 1919.

Every possible effort is being made by the State and Federal Government to eradicate the European Corn Borer [*Pyrausta nubilalis*]. Complete destruction of the maize stalks is necessary, as the borer hibernates in them. Experiments are being made with liquid fire and crushing machines for this purpose. This pest has not as yet been reported from Pennsylvania, but careful watch is being maintained against its introduction.

LYNE (W. H.). **Report of Inspector of Imported Fruit and Nursery Stock.**—*13th Ann. Rept. Dept. Agric. 1918, Victoria, B.C.*, 26th March 1919, pp. W36–41.

Wheat offered for entry into British Columbia from Australia was found to be heavily infested with weevils, as well as *Plodia* sp. and *Tribolium* sp. Owing to the large bulk of the consignments, complete fumigation was impossible, but prior to shipment to England, the wheat was passed through a fanning machine by which means nearly all the insects were separated from the wheat and subsequently disposed of by fumigation with carbon bisulphide. Wheat thus treated was examined on 18th September, when no adult weevils were found, but they began to appear after about four weeks, and by 31st December 588 individuals were recorded to the pound. Various experiments were made during the year to ascertain the best method of dealing with infested stored products. These included cold storage, by which means all insects infesting rice were killed after an exposure of 14 days to 10° below freezing. Exposure to 130° F. for 3 hours gave the same result, but the heat is supposed to spoil the rice for milling, as it cracks the enamel.

Pests responsible for condemnation of imported nursery stock included *Phylloxera* on vines; woolly aphis [*Eriosoma lanigerum*] on apple roots; *Eriosoma pyricola* attacking roots of young pear trees; codling moth [*Cydia pomonella*] on apples and pears; peach worm on peaches and apricots; and Bruchids in nutmegs from Singapore. Products requiring fumigation included peas and beans infested with *Bruchus pisorum* or *B. fabae*; Oriental rice infested with rice weevil [*Calandra oryzae*], *Plodia* sp. and other Lepidopterous larvae; peanuts infested with *Plodia*; and rabbit skins infested with Dermestid beetles from Australia.

HOLDER (C. H.). **Report of the Fruit Experiment Station, Shillong, for nine Months ending the 31st March 1919.**—*Rept. Agric. Expts. & Demonstrations in Assam for nine Months ended the 31st March 1919, Shillong*, 1919, pp. 45–73.

Cockchafer grubs were very numerous in light soil, necessitating its removal in the immediate neighbourhood of fruit trees. Thousands of beetles were caught by means of light-traps in May and June. Injury to apples is attributed to the larva of a weevil which eats small patches in the fruit and oviposits in excavations along the edges of such patches. Calyx spraying with lead arsenate solution was carried out, but it is uncertain whether this will prove successful against this pest. A brown weevil is also reported attacking apple shoots and another species is very destructive to fig trees.

DEN DOOP (J. E. A.). **Levensgeschiedenis van *Epilachna dodecastigma*, Mulsant, in Deli.** [The Life-History of *E. dodecastigma* in Deli.]—*Teysmannia, Batavia*, xxx, no. 6, 1919, pp. 243–253, 1 plate.

The Coccinellid beetle, *Epilachna dodecastigma*, Muls., occurs in Deli, Sumatra, on *Datura fastuosa* and *Physalis minima*. In captivity it feeds on potato leaves. In Deli it may be counted among the beneficial insects, for *P. minima* is a weed in tobacco plantations, its fruits being the preferred food (next to tobacco) of *Heliothis obsoleta*, F., one of the two most dangerous pests of tobacco. In the laboratory about 70 per cent. of the eggs hatched out. The egg-stage lasted 4–5 days, the larval stage 14–19 days, and the pupal stage 4–5 days. The complete life-cycle, from oviposition to emergence of the adult, occupied 24 days on an average. The adults are parasitised by Acarines and there is a Chalcid egg-parasite larger in size and lighter in colour than the species of *Trichogramma* infesting *H. obsoleta*, in the eggs of which it could not be bred. The incubation period of this parasite is about 10 days.

FEYTAUD (J.). **Action de la Chaleur et de la Sécheresse sur la Cochylis.**—*Jl. Agric. Pratique, Paris*, xxxii, no. 34, 25th September 1919, pp. 690–692, 1 fig.

Observations on *Clysia* (*Cochylis*) *ambiguella*, Hb., during the last ten years show that this moth is greatly influenced by atmospheric conditions. Details are given of the weather conditions and the counts made for each year. Hot, dry weather kills all the stages of this moth.

LEES (A. H.). **Two Pests of the Rose.**—*Gardeners' Chronicle, London*, lxvi, no. 1707, 13th September 1919, p. 139, 1 fig.

The rose-leaf miner, *Nepticula anomalella*, has two generations a year. The larvae are found in July, September and October, the adult Tineids appearing in May and August. The infested leaves should be removed and destroyed or else the larvae crushed in their galleries, thus allowing the leaves to continue their function.

A description is also given of *Tortrix bergmanniana*, which is found all over the United Kingdom, but chiefly in the south. The larvae,

found in May and June, spin the edges of young leaves together in which they live for some time; later they may be seen among the shoots feeding on the foliage. They pupate amongst the twisted leaves and the adults may be seen on the wing from the end of June to July. Remedial measures advocated are hand-picking and spraying with lead arsenate.

J. F. **Onion Fly on Leeks.**—*Gardeners' Chronicle, London*, lxvi, no. 1709, 27th September 1919, p. 168.

Attention is drawn to the occurrence of *Hylemyia antiqua* (*Anthomyia ceparum*) at the base of leek seedlings of the Champion and National varieties, whilst Musselburgh leeks were untouched.

TREHERNE (R. C.). **Notes on Thysanoptera from British Columbia.**—*Canadian Entomologist, London, Ont.*, li, no. 8–9, August–September 1919, pp. 181–190, 3 plates.

The thrips here recorded include *Orothrips kelloggi yosemitii*, Moult., on *Amelanchier* in July; *Aeolothrips fasciatus*, L., on *Lithospermum pilosum, Elymus condensatus*, clover, *Crataegus*, cherry, *Prunus demissa* and *Amelanchier*, during May, June and July, and also found in association with *Thrips tabaci* (onion thrips) on which it is probably predaceous. It is recorded as predaceous on *Kakothrips pisivorus*, Westw., in Europe, although it also feeds on the pollen and juices of plants. *Aeolothrips annectans*, Hood, has been taken during May, June and July on a variety of plants, including *Acer glabrum, Ribes viscosissimum, Sambucus racemosa, Ilex europaeus*, apple, alder, *Lithospermum pilosum* and *Amelanchier florida*. It is associated with, and probably predaceous on *Thrips tabaci*. *Aeolothrips auricestus*, sp. n., was found on western wild rye grass (*Elymus condensatus*). *Taeniothrips inconsequens*, Uzel (pear thrips) is also described, and other species mentioned are: *Thrips physapus*, L., on dandelion in April and May and *Rubus parviflorus* during June; *Thrips tabaci*, Lind. (onion thrips), of which the larvae of the first generation appear early in June; *Haplothrips statices*, Hal., found on apple, plum, *Spiraea discolor* and other native shrubs, and possibly also injuring red clover; *Leptothrips mali*, Fitch, taken during May, June and July from the foliage and branches of *Acer glabrum*, alder, *Amelanchier*, apple, peach and *Crataegus*; and *Chirothrips manicatus*, Hal., on many roadside grasses.

MATHESON (R.). **Notes on *Pelenomus sulcicollis*, Fåhrs. (Curculionidae).**—*Canadian Entomologist, London, Ont.*, li, no. 8–9, August–September 1919, pp. 199–201, 1 plate, 1 fig.

Pelenomus sulcicollis, Fhs., of which all stages are described, was found in large numbers infesting fringed loosestrife (*Steironema ciliatum*) in New York State. The eggs are laid singly beneath the lower epidermis of the leaves near the veins as a result of which that area dies and becomes brown. The larvae feed on the lower surface of the leaves and when mature spin a small cocoon on the under surface or axil of the leaf, in which they pupate. The weevils emerge

after about two weeks and feed extensively on the tissue, stems and midribs of the leaves. They are most abundant during August and early September and probably hibernate amongst fallen leaves and rubbish.

Grasshoppers in Okanogan County.—*Washington State Dept. Agric. Mthly. News Letter, Olympia*, i, no. 4, July 1919, p. 1. [Received 20th October 1919.]

An account is given of a campaign for poisoning grasshoppers in Okanogan County, Washington, carried out under the direction of Mr. A. C. Burrell, upon whose research work the campaign was based. It was estimated that seven billion eggs were laid in 1918. During May and June, 1919, some three billion of these have hatched over an area of about 400 acres stretching into British Columbia, the species concerned being *Camnula pellucida*. The breeding-places were covered with numbers of small black hoppers, which were treated with coal-oil, as many as 200 being frequently killed per square foot. Those that survived marched in hordes into the winter and spring wheat and were treated with the Government poison-bait of Paris green in a salty mixture of mill feed and sugar-beet molasses flavoured with imitation lemon extract. As many as four million hoppers per acre were killed by this means, about ten pounds (5 lb. dry) of the bait being used to the acre. Up to the time of writing, about £160 has been expended on the campaign, practically the whole of the three billion hoppers having been destroyed. The rapid action of the bait enabled the wheat to spring up again and renew its growth, so that the loss amounted to practically nothing, except in a few cases owing to farmers' carelessness. The loss from grasshoppers in the same district the previous year was computed at about £16,000; it is impossible to forecast the damage that might have occurred in 1919, if prompt action had not been taken at the time of hatching.

Ball (E. D.). **The Potato Leafhopper and the Hopperburn that it causes.**—*Bienn. Rept. Wisconsin Dept. Agric. 1917–1918, Madison*, Bull. 20, 31st December 1918, pp. 76–102, 5 plates, 2 figs. [Received 15th September 1919.]

The bulk of the information here given on *Empoasca mali* has previously been noticed [see this *Review*, Ser. A, vii, p. 278].

The remedial measures advocated are the use of a spray of Black-leaf 40 at the rate of 1 part to 800 of water and 5 parts of soap. Poisons may be added so as also to kill the potato beetle [*Leptinotarsa decemlineata*] or the mixture without the soap may be added to Bordeaux mixture. Kerosene emulsion should be used as strong as possible, so long as it does not cause scorching of the foliage; 7–8 per cent. of kerosene or 1 part of stock emulsion to 8 parts of water was found satisfactory. It is imperative that the under-sides of the leaves should be reached with the spray.

In Wisconsin about 5 to 10 per cent. of the eggs were found parasitised, probably by a Dryinid, as yet unidentified. The only other natural enemy is the fungus, *Entomophthora sphaerosperma*, which however does not materially reduce the numbers of this pest.

SWEZEY (O. H.). **Cause of Scarcity of Seeds of the Koa Tree.**—*Hawaiian Planters' Record, Honolulu*, xxi, no. 2, August 1919, pp. 102–105, 6 figs.

Acacia koa, one of the most important of the Hawaiian forest trees, has become greatly reduced in numbers, and, while easy to propagate, cannot rapidly be reproduced owing to the difficulty of obtaining seeds. The trees blossom profusely, but the growing pods are attacked by the larvae of four species of Tortricids, namely, *Adenoneura rufipennis*, *Enarmonia walsinghami*, *Cryptophlebia vulpes* and *C. illepida*, which travel from seed to seed devouring them as they go. Observations on pods from various localities show a very low percentage (0 to 13 per cent.) of sound seeds. Several Hymenopterous parasites are known to attack the larvae, but at the present time are not sufficiently numerous to be effective.

TIMBERLAKE (P. H.). *Popilia japonica*, **a serious Pest recently introduced into New Jersey from Japan.**—*Hawaiian Planters' Record, Honolulu*, xxi, no. 2, August 1919, pp. 106–109, 5 figs.

Popillia japonica, Newm., recently introduced from Japan, is at present confined to a relatively small area in New Jersey [see this *Review*, Ser. A, vii, p. 394, where it is recorded in error as *Adoretus*], but it has shown adaptability to its environment and a tendency to spread with considerable rapidity, and unless promptly exterminated it will unquestionably spread over a great part of the United States. The life-history and habits of this Scarabaeid beetle have been previously discussed [see this *Review*, Ser. A, vi, p. 440]. A great many plants are attacked, including apple, peach, grape, raspberry, watermelon, asparagus, sweet potato, lima beans and the ears of maize, and ornamental trees and shrubs such as rose, *Spiraea*, hollyhock, ferns, iris, elm, willow and birch. Many weeds are also attacked including elderberry, morning-glory, dock, etc.

For preventing the spread of infestation the following measures are proposed by the Federal and State authorities for 1919. The establishment and maintenance of a band ½ mile wide around the infested area throughout which all non-economic plants attacked by the beetle should be kept covered with a film of poison during the period of flight. The destruction of all non-economic food-plants along roadsides in the infested area and the provision of a poisonous coating on all economic food-plants; the removal of farm products from the infested area to be permitted only during the warm parts of the day, and the restriction as far as possible of persons going among infested plants during the evening or early morning. All green sweet maize within the infested district to be removed only under quarantine regulations.

For the destruction of the beetle within the infested district it is proposed to establish and maintain a poisonous coating on all economic food-plants, except in certain areas where they are to serve as traps and in which the beetles will be collected by hand. In the spring the soil will be treated with sodium cyanide in solution, and the ground kept well cultivated so that the ovipositing beetles will not be encouraged. All waste land about cultivated places will be eliminated as far as possible, thus reducing the area on which attractive food-plants may grow and in the soil of which the beetles may oviposit.

LYON (H. L.). **Notes on Sugar Cane Culture in Java.**—*Hawaiian Planters' Record, Honolulu*, xxi, no. 2, August 1919, pp. 109–128, 12 figs.

In the course of this paper it is remarked that Java planters do not advocate the stripping of their cane as a cultural practice, but they find it necessary in certain cases in order to stop the ravages of the stem shield-scale, *Chionaspis madiunensis*, Zehnt. This Coccid attaches itself to the surface of the internodes and, when sufficiently numerous, causes considerable injury to the canes.

RUMSEY (W. E.). **Peach Tree Borer.**—*Canadian Horticulturist, Toronto*, xlii, no. 9, September 1919, p. 222.

Experiments made in West Virginia with sprays of miscible oil or an emulsion of Avenarius carbolineum and soap appeared to be effective against the peach-tree borer [*Aegeria exitiosa*], though further results are necessary to prove their efficacy against this pest. The best time for spraying is the end of September or beginning of October when the young caterpillars are just beneath the bark. After removal of the soil round the base of the tree the bark should be allowed to dry and then sprayed with the oil at the rate of one part to eight parts of water at a pressure of at least 100 lb. to about 6 or 8 inches above the general surface level, the soil being then replaced.

Work in Connection with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. Antigua, 1917–18*; *Barbados*, 1919, pp. 13–15. [Received 4th October 1919.]

Grubs of the brown hardback beetle (*Lachnosterna* sp.) caused great damage to sugar-cane during the year under review. The planting of maize as a trap-crop has been suggested and has proved useful on the few estates where it was tried.

Pests attacking cotton included: *Alabama argillacea*, against which regular applications of Paris green and lime were of little or no avail owing to continued rain. *Dysdercus* sp. (cotton-stainers) were abundant and *Heliothis obsoleta* (*armigera*) (bollworm), *Saissetia nigra* (black scale), *Hemichionaspis minor* (white scale) and *Eriophyes gossypii* (leaf-blister mite) were also reported. The flower-bud maggot, *Contarinia gossypii*, has not been noticed for several years in Antigua. Early planting is suggested as the best remedial measure should this midge make its appearance.

Lepidosaphes beckii (purple scale), *Coccus viridis* (green scale), *Chrysomphalus aurantii* (red scale), *Chionaspis citri* (white scale) and *Diaprepes* (*Exophthalmus*) *esuriens* were reported on limes, the weevil being particularly abundant. The infestation of sweet potatoes by the weevil, *Euscepes* (*Cryptorrhynchus*) *batatae*, has increased during the year.

JEGEN (G.). **Beiträge zur Kohlweisslingsbekämpfung.** [Contributions to the Work of combating the Cabbage Butterfly.]—*Landwirtschftl. Jahrbuch d. Schweiz, Berne*, xxxii, no. 4, 1918, pp. 524–550. [Received 4th October 1919.]

The rôle played by the parasites of *Pieris brassicae*, which caused severe loss in Switzerland in 1917, has been investigated at the

Experimental Institute at Wädenswil. Examinations of the hibernating pupae showed that those found in exposed situations were of a dark colour and never yielded adults; these emerged only from the bright green pupae taken from sheltered positions. The caterpillars of the summer generation usually pupate on the food-plant, but cold weather causes those of the autumn generation to seek more elevated situations that protect them against damp and cold. Mild weather in autumn may sometimes lead to this migration not taking place and in these cases the cold weather later on destroys the unprotected pupae. Parasitised larvae pupate earlier than others and are unable to reach suitable shelters; the collection of the winter pupae of *P. brassicae* therefore has little value and may even be harmful.

As the pupal stage of the parasites lasts longer than that of the host, the host-larvae are already present when the parasites begin to oviposit. Ichneumonid and Braconid parasites are more numerous than Tachinids. The Hymenoptera chiefly concerned are *Apanteles* (*Microgaster*) *glomeratus*, *Pimpla instigator*, and *Pteromalus puparum*, the last-named being the most numerous. In autumn *Pteromalus* appear to parasitise female pupae by preference.

Experiments were made to ascertain where the eggs of the first generation of *P. brassicae* are laid. There does not seem to be any preferred food-plant. The eggs were found, singly, on *Brassica oleracea* (cabbage), *Knautia arvensis*, *Plantago minor*, *Taraxacum officinale* (dandelion), *Heracleum sphondylium*, *Trifolium pratense* and other plants. No eggs were laid on meadow grasses or on *Caltha palustris*. The egg-stage lasts 10–12 days, the larval 34–38 and the pupal 14–18 in summer and up to 5 months in winter. The entire life-cycle occupies 58–68 days in summer. In the present case the first generation appeared in April and May and the second from the end of June to the end of July. The second did comparatively little damage as a result of the extensive parasitisation of the first. This occurred chiefly on the first day of the larval stage, so that it appears that the Hymenoptera concerned, *Pimpla* and *Pteromalus*, mainly attack the younger stages. In these experiments Tachinids, which are frequently found in winter pupae, were not observed, but the larvae examined were not more than 8 days old, and Tachinids appear to oviposit in older ones. Other experiments are described in which the parasites were placed near eggs about to hatch. The short (3–4 day) egg-stage of *Apanteles glomeratus* appears to be due to the fact that this Braconid oviposits on the skin of the larva and a long egg-stage might entail the destruction of the egg when the host-larva moults. Loos has calculated this loss at 40 per cent. in the case of Tachinid parasites [see this *Review*, Ser. A, vii, p. 499]. The eggs of *Pimpla investigator* are laid within the body of the larva and oviposition is not confined to young individuals, being carried on for a fortnight. From 14 to over 100 eggs are laid in one host. As *Pteromalus puparum* deposits eggs from the beginning to the end of the larval stage of the host it necessarily happens that some of the adult parasites emerge at a time when no larvae of *P. brassicae* are available. This is no disadvantage as *P. puparum* attacks other larvae, such as those of *Hyponomeuta malinellus*. More than 100 eggs may be laid in one host.

Fungus diseases may kill from 16 to 35 per cent. of the larvae, especially in wet weather, and a second generation, reduced by these agencies, provides less breeding facilities for the parasites with the result that in the following year their position becomes very unfavourable, and a fresh outbreak of *P. brassicae* occurs later on.

The best direct artificial measure against *P. brassicae* consists in crushing the eggs and collecting the larvae. This may be supplemented by the capture of the butterflies, especially those of the first generation. Preventive measures include the collection of non-infested pupae, and the spraying of cabbage seedlings with a 2 per cent. nicotine solution to repel the ovipositing butterflies. Spraying must be repeated from time to time, as the repellent effect has been found to disappear in about 9 days.

SMYTH (E. G.). **Report of the Division of Entomology.**—*Ann. Rept. Porto Rico Insular Expt. Sta., Rio Piedras*, 1st July 1917 to 30th June 1918, 1919, pp. 109–129. [Received 6th Oct. 1919.]

Insect pests intercepted during 1917–1918 include:—Various Aphids on flowering greenhouse plants from the United States, such as *Macrosiphum* (*Siphonophora*) sp. on roses; *Pseudococcus* spp. on ornamental plants; *Tetranychus quadrimaculatus* (red spider); the leaf-tyers, *Phlyctaenia ferrugalis*, Hb., and *Tortrix* (*Archips*) *parallela*, Rob.; *Aleurodes vaporariorum*, Westw. (greenhouse whitefly); fern scales; palm scales; and mites. *Thrips tabaci* was intercepted on onion seedlings and a Psocid on pineapple seedlings from Hawaii. Most of the species that are greenhouse pests in the United States are capable of becoming very dangerous outdoor pests in Porto Rico; this has already happened in the case of the Nematode, *Heterodera radicicola*. Interceptions from foreign ports included a Capsid, probably *Tenthecoris bicolor*, on orchids from Venezuela; a large cockroach, perhaps *Leucophaea* sp., in the packing with orchids from Santo Domingo; the mite, *Stigmaeus floridanus*, Banks, in pineapples from Cuba; a new mealy bug, *Pseudococcus* sp., on carnations and sunflowers from Santo Domingo; a Ptinid beetle in cacao beans and a Bruchid in *Cassia* beans from Santo Domingo; many grain weevils, *Calandra oryzae* and *Spermophagus pectoralis*, in maize and beans from Venezuela and Santo Domingo. It is suggested that a regulation should be promulgated requiring the fumigation of every load or shipment of grain entering the Island from a foreign port. Rigid quarantine measures have been maintained against importations of *Citrus*, and were extended in February 1918 to pineapple fruits or plants.

A series of experiments is to be undertaken to determine the possibility of dissemination by insects of the mottling disease of sugar-cane. Possible factors in this respect are *Tettigonia similis*, Wlk., a green leaf-hopper found on Para grass in the vicinity of canefields, or *Xyleborus* sp. (cane shot-hole borer), which was abundant in decaying cane seed stalks in a field that was badly infested and where the disease was spreading rapidly.

The damage by white-grubs [*Lachnosterna*] to sugar-cane is increasing. In some localities where they have not been very abundant in previous years it is now necessary to resort to hand-picking. There is great need of some cheaper and more efficient remedy for white-grubs in

sugar plantations. It is suggested that skunks and toads, which eat large numbers of them and of the adult May-beetles, should be introduced from the mainland. The hard-back beetle, *Dyscinetus trachypygus*, Burm., was reported as greatly injuring sugar-cane on the north coast. This Dynastid is very common in Porto Rico, the larvae feeding upon decaying ratoons of sugar-cane and other grasses and upon organic matter in the soil, but not apparently attacking healthy roots. The life-histories of this and other species have been worked out [see this *Review*, Ser. A, iv, p. 356]. The beetles were found in great numbers feeding on the roots and underground stems of the young cane, causing it to turn yellow and in some cases to die. They had probably bred in grass lands in the vicinity or in the decaying stools of the previous crop in the same field. Their presence constitutes one objection to the practice of not burning cane-trash after cutting the cane. It is suggested that trap-lanterns, placed over pans of water and kerosene, should be used during the flight of the beetles, and that night collections with lanterns should be made. A poison-bait consisting of 1lb. white arsenic or Paris green and two quarts of cheap molasses, mixed with a bushel of bran or lucerne meal and water to moisten it, might be effective if scattered around the infested canes after sundown.

An important discovery during the year was that of a species of *Tetranychus* (red-spider) attacking the foliage of sugar-cane. It was first noticed on cane growing in pots in the latter part of April 1918, on both surfaces of the leaf, forming a light webbing over the surface and causing a mottled appearance of the leaves. The same pest was observed in rearing cages on the south side of the Island four years ago, but was not identified. The only previous report of a red-spider attacking sugar-cane seems to be of *T. exsiccator*, Zehnt., occurring in Java, but this is obviously a different species, being red in colour while the Porto Rican species is a yellowish white. There is a possibility of severe injury to cane by this species during periods of unusually high temperature.

A severe outbreak of *Sipha flava* (yellow cane aphis) occurred during March and April on young seed-cane. These outbreaks are not uncommon and are generally controlled by natural enemies before severe injury results. Similar attacks have been recorded on older cane but do not seem to cause the death of the plants. Experiments showed spraying with contact insecticides to be unnecessary as in untreated plots natural enemies proved equally efficacious.

Strategus quadrifoveatus, Beauv. (larger rhinoceros beetle) has been recorded as causing severe injury to young coconuts and to mature sugar-cane, some palms being killed by their attacks. It is proposed to carry out experiments to determine suitable methods of controlling the beetle; in the meantime the following remedies are suggested for trial. The coconut in the husk might be dipped, before planting, into a repellent liquid such as tar-oil or carbolineum, which retains its odour for a long time. It is believed that it is the rotting wood that attracts the beetles to oviposit and on which the larvae feed. Another method, used with success in Samoa, is to collect the rubbish, dead logs and stumps into piles in the coconut plantations. These attract the ovipositing beetles and should be examined monthly and all grubs and beetles in them destroyed.

The worst garden pests were *Pieris (Pontia) monuste*, L., and *Plutella maculipennis*, Curtis, attacking cabbages, radishes and turnips. Hedges of orange-jasmine (*Murraya exotica*) were injured by the scales, *Chrysomphalus aurantii*, Mask., *Lepidosaphes beckii*, Newm., and *Saissetia hemisphaerica*, Targ., and required spraying with paraffin oil and soap emulsion. An undetermined species of *Pseudococcus* was a new pest on peanuts, being abundant on the roots and pods of the plants and reducing the crop by 50 per cent. or more. These mealy-bugs were attended by large numbers of the dark-brown ant, *Prenolepis* sp. The Termite, *Eutermes morio*, Lath., has been reported as injuring sugar-cane seeds, *i.e.*, sections of stalk, after planting in the fields; this probably occurs when the cane seed has been allowed to lie about and become infested before planting. Damage to buildings and furniture by this termite is much more common. Timbers of houses or flooring should be soaked or painted with carbolineum or a similar fluid before use; furniture when attacked should be well soaked with kerosene. The investigations and insect-control work for the coming year are outlined.

Gibson (E. H.). **Relation of the Systematist to the Economic Worker.** —*Bull. Brooklyn Entom. Soc., Brooklyn, N.Y.*, xiv, no. 1, February 1919, pp. 1–3. [Received 6th October, 1919.]

Stress is laid upon the importance of co-operation between the systematist and the economic worker in entomology. It is considered that mutual assistance might be rendered by prompt determination and return of specimens, by supplying references and bibliographies of insects that are being studied by economic workers and by limiting monographic work to groups that are of economic importance. On the other hand, full data should be sent when submitting specimens for identification and a reasonable time should be allowed for determination. The ignorance of each other's work that exists between these two groups of entomologists is deplored, and it is suggested that young men starting as economic entomologists should choose some small and well defined group of insects for taxonomic study and that those who contemplate systematic work should spend at least a part of two years doing biological and economic field work.

Knight (H. H.). **The Male of *Lygus univittatus* with the Description of a new *Lygus* (Hemip., Miridae.).**—*Bull. Brooklyn Entom. Soc., Brooklyn, N.Y.*, xiv, no. 1, February 1919, pp. 21–22, 1 fig.

It is considered that *Lygus univittatus*, Knight, which has been described from the female only, and of which both sexes have now been taken on *Crataegus*, may probably become an apple pest, since apple red bugs now established as pests of cultivated apples came from *Crataegus*. *Lygus (Neolygus) parrotti*, sp. n., is described, having been found breeding on *Viburnum sterilis* and *V. opulus* in New York.

Eustace (H. J.) & Pettit (R. H.). **Spray and Practice Outline for Fruit Growers.**—*Michigan Agric. Expt. Sta., East Lansing*, Spec. Bull. 93, February 1919, 32 pp., 6 figs. [Received 6th October 1919.]

General directions are given for spraying for the use of fruit and vegetable growers, and are particularly applicable to the average

conditions existing in Michigan. Various formulae are discussed and directions for making home-made solutions are given with a table of dilutions for concentrated lime-sulphur wash. A comparison is made between dusting and spraying in orchards, the former procedure being considered to be still in the experimental stage.

CRESPO (M. A.). **Dominio del Gorgojo ó Piche de la Batata** (*Cylas formicarius*). [Economic Importance of the Sweet Potato Weevil.] —*Rev. Agricultura, Santo Domingo, R.D.*, xv, no. 5, 31st August 1919, pp. 152–157, 2 figs.

In the Dominican Republic, *Cylas formicarius* (sweet potato weevil) is responsible for the loss of some 60 to 90 per cent. of the sweet potato crop, many fields having been abandoned owing to its depredations. Sweet potatoes and related native plants only are attacked, the eggs being laid on the roots. The larvae upon hatching penetrate into the tubers, giving them an unpleasant taste, so that even pigs refuse to eat them. A description of the insect is given, with its distribution and the usual remedial measures. Late varieties have proved on the whole more resistant than early ones. It is considered that quarantine laws should be passed with a view to limiting the spread of the insect, and the importance of co-operation in carrying out remedial measures is emphasised.

WOODRUFFE-PEACOCK (E. A.). **Two Phytophagous Chalcids.**—*Naturalist, London*, no. 753, October 1919, pp. 329–330.

A Chalcid provisionally identified as *Syntomaspis druparum*, Boh., and previously erroneously recorded as *Tomyrus elegans*, was found emerging from seeds of *Crataegus oxyacantha* (hawthorn), which had passed through the alimentary canal of a blackbird and were kept in a tube from 30th March to 29th June, when the adult appeared. This species is phytophagous and also feeds on seeds of apples. The larvae were found by the author in March 1918 in seeds of *Pyrus sylvestris* (*acerba*) in fruits that showed no external opening. Another phytophagous Chalcid was found in tubes containing seeds of rough chervil (*Chaerophyllum temulum*).

CHAMPION (H. G.). **A Cerambycid infesting Pine Cones in India,** *Chlorophorus strobilicola*, **n. sp.**—*Entomologist's Mthly. Mag., London*, no. 58, October 1919, pp. 219–224, 2 plates, 1 fig.

The different stages of *Chlorophorus strobilicola*, sp. n., are described. The eggs of this Cerambycid are laid at the end of June and beginning of July in the crevices between the scales of the full-sized green cones of *Pinus longifolia*, usually on trees about 15 months old. The shaded concave side of the cone is chosen and about 15 to 20 eggs deposited in each. These hatch in about two weeks and the young larvae bore immediately into the cone feeding on the internal wood tissues but avoiding the strongly lignified vascular tracts. Infested cones are usually broken off by the wind, but the fall does not injure the larvae and they complete their metamorphosis inside the fallen cone. Badly infested cones are easily recognised by their arrested development. Should only a few larvae be present in the cone, development is not hindered,

though no fertile seeds are formed. Pupation occurs about April and lasts about two weeks. The earliest and latest dates of emergence of adults are recorded as 14th April and 15th May, but this may depend on altitude, etc. The adults emerge through oval holes in the scale-head. The life-history is subject to variations, the chief of these being that some larvae take two years to become mature. Natural enemies were not found, although several larvae were attacked by a fungus. This is not however an important factor in the check of this pest, as larvae found in the same cone as those infested with the fungus proved not to be diseased. This beetle is distributed throughout the chir (*Pinus longifolia*) forests of the W. Almora Forest Division and probably of Kumaon and is found at an altitude range of from 3,500 to 6,500 feet. It is most common in open sunny stands. In these districts the damage caused in 1918 and 1919 probably amounted to 40 per cent. or more.

LAING (F.). **A Note on four British Coccids.**—*Entomologist's Mthly. Mag., London*, no. 58, October 1919, pp. 233–234.

An outbreak of *Kermes quercus*, L., on oak trees is recorded in Richmond Park and at Wimbledon. Many individuals were heavily parasitised, but the parasite was not identified.

Orthezia urticae, L., was found on *Artemisia maritima* at Shoeburyness, *O. cataphracta*, Shaw, amongst beech leaves under stones near Aberdeen, and *Eriopeltis festucae*, Boy., on *Festuca ovina*.

DUPORT (M.). **Rapports du Sous-Inspecteur des Services Agricoles de l'Indochine.**—*Station Entom. de Cho-ganh*, nos. 2 & 3, October-December 1918 & January-March 1919; Supplements to *Bull. Chambre d'Agric. du Tonkin et du Nord-Annam, Hanoi*, nos. 120 & 121, 1918 & 1919, 4 & 7 pp. [Received 7th October 1919.]

During 1918 further experiments were made with a view to discovering other food-plants of the coffee borer, *Xylotrechus* [*quadripes*] [see this *Review*, Ser. A, vii, pp. 50 and 269]. They are apparently not very numerous, but when tests were made with newly-felled or dry logs of some thirty other plants, these were readily chosen by the borers for oviposition, even when placed in the same cage with coffee plants. Teak is undoubtedly a preferred food-plant, quite large trees being attacked. Teak logs are chosen in preference to all others; living teak is also attacked, but the larvae apparently cannot develop in it. Evidently the borer breeds more rapidly in dead or newly-felled trunks than in living plants, and therefore many other centres of contamination occur besides diseased coffee plants. Of some hundred trees and shrubs examined, about a dozen can be classed as very favourable to the multiplication of the borer, while another 20 are chosen in the absence of preferred food-plants. Further examinations will be made. Bamboos are seldom attacked when green, and when dry are rejected in most cases for other plants. Teak and *Gardenia* seem to be the favourite cultivated plants. Pending the completion of a list of food-plants, it is considered unwise to make fences, etc., of wood that might be infested by this borer, or even to keep such wood in bundles, without treating it with Stockholm tar or coal-tar. As regards the various trees used to provide shade for coffee bushes in

Tonkin, the tree known as "soan" and the "bancoulier" [*Aleurites moluccana* (candle-nut)] do not seem at all attractive to the borer. A coating of resin, oil and starch, mixed while hot, should give good results. It is inexpensive, and three months after application is still sufficiently viscid to act as a repellent.

In January the adult borers began to emerge from the experimental branches and were examined. The teak branches were riddled with emergence-holes, the adults appearing barely 3½ months after oviposition. They were apparently a little smaller than the average size; this may have been due to crowding among the larvae. From freshly-cut *Gardenia* used in the same experiments the adults were also a little smaller than those emerging from coffee. In *Albizzia*, which was suspected of being a favourite food-plant, no galleries have appeared. Among newly tested living plants, *Randia dumetorum* was attacked by *X. quadripes*, and produced two normal adults, 7½ months after oviposition. This plant is largely grown, the fruit being eaten by the natives. Another native tree, *Oroxylon indicus*, was chosen for oviposition, sometimes in preference to coffee, and galleries were observed in the wood, but the experiments with this tree were not completed. If these conditions are reproduced naturally in the field, it is hoped that the branches of these plants may be utilised as traps; teak logs placed at the foot of coffee bushes are already being tested in this way.

Washes and bands have not been very successful; the former have proved either ineffective or noxious to the trees, though possibly in the case of quite old trunks a coating of bird-lime might not be injurious. Bands are more expensive and only drive the beetles to oviposit above them and on the branches, whence the larvae descend to the trunk. The life-cycle varies according to the severity of the winter, being proportionately longer for those insects that hibernate as larvae in the trunks. Examples are quoted that indicate a shorter larval stage on newly-felled logs than on living plants.

Other insect pests of coffee plants include an unidentified white scale that lives on the underground part of the plant and encourages a disease that quickly spreads all over the roots and causes the death of the plant by suffocation, in much the same way that *Pseudococcus* (*Dactylopius*) *vitis*, Nied., infests vines in Palestine. The only remedy as yet known is to pull up and burn immediately all plants so affected.

Rice pests in Tonkin include *Schoenobius incertellus*, Wlk., the larvae and pupae of which pass the winter in rice stubble left in the fields. The obvious remedy is to destroy the stubble, but it is doubtful whether growers will do this. Parasites of the larvae are numerous, but do not prove an effective check. Young rice plants are also considerably injured by the caterpillars of another moth, *Sesamia inferens*, Wlk., which mine the stalks and also live and pupate outside at the base of the plants. As the rice-growers object to destroying the infested stubble the damage is spreading.

HUTSON (J. C.). **Some Minor Insect Pests in Ceylon in 1919.**—*Trop. Agriculturist, Peradeniya*, liii, no. 2, August 1919, pp. 139–141. [Received 8th October 1919.]

The insect pests reported for the first half of 1919 include: *Saissetia hemisphaerica* on twigs and leaves of tea, giving rise to the development

of a black fungus upon them. A Fulgorid, *Ricania fenestrata*, was found on tea at the end of March and *Ricanoptera opaca* in May. This is probably the first record of *Ricania* in Ceylon. The insects in all stages cluster on the small twigs and leaf-stalks and feed by sucking the plant juices. Severe infestation may cause withering of the leaves and twigs. Both species may be destroyed by collecting the young stages or cutting and burning the infested twigs. Other tea pests include a Limacodid moth, *Spatulicraspeda castaneiceps*, and a midge, *Oscinis theae*. The larvae of the latter feed inside the leaf under the upper epidermis and should be at once destroyed by picking and burning the leaves.

Owing to the late planting of cotton there was a severe outbreak of *Dysdercus cingulatus* (cotton-stainer), which apparently has similar habits to allied species in the West Indies. The local food-plants include the silk cotton tree (*Eriodendron anfractuosum*), the red cotton tree (*Bombax malabaricum*), okra (*Hibiscus esculentus*) and *H. rosa-sinensis*. Remedial measures advocated are shaking of all stages from the bushes into tins of kerosene and water or the use of traps consisting of damaged bolls and cotton refuse, etc., in which the bugs should be destroyed with boiling water or by burning with torches. The Pyralid, *Sylepta derogata*, on cotton may be destroyed by collecting or crushing the caterpillars on the leaves. They are heavily parasitised by a small brown Hymenopteron, as yet unidentified. Another Pyralid, *Terastia meticulosalis*, was found tunnelling in the ends of young shoots of dadap (*Erythrina lithosperma*) causing dropping of the terminal leaves. In young plants the affected shoots should be cut off and destroyed.

Ellis (A. G. G.). **Notes on the Work of the Inspection Staff during 1918.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, vii, no. 3, May–June 1919, pp. 144–150. [Received 8th October 1919.]

Termites continued to be seriously injurious to rubber during 1918, especially in peat soil. Leaf-mites were plentiful and are believed to do much more damage than is generally recognised. Trees damaged by fire are liable to attack by stem borers, and those that have been thinned out should be removed as soon as possible.

Leaf-hoppers infested rice to a serious extent in January, but remedial measures proved unnecessary owing to the activities of natural enemies and the occurrence of heavy rains. Stem-boring caterpillars and sucking insects also caused some injury to growing rice.

Rhinoceros beetles [*Oryctes rhinoceros*] and red weevils [*Rhynchophorus ferrugineus*] do considerable damage to coconut trees; any substance in which they are likely to breed should be promptly destroyed. An unusually bad outbreak of *Brachartona catoxantha* occurred in Perak and lasted from February to September. The palms, however, recovered remarkably quickly towards the end of the year. Locusts have not caused much trouble during the year; swarms appeared in various districts, but no extensive oviposition seems to have occurred.

Snyder (T. E.). **"White Ants" as Pests in the United States and Methods of Preventing their Damage.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 1037, June 1919, 16 pp., 11 figs. [Received 9th October 1919].

The bulk of the information in this bulletin on termites has been previously noticed [see this *Review*, Ser. A, v, p. 147].

Insect Enemies and Diseases of the Tomato.—*U.S. Dept. Agric., Washington, D.C.*, Dept. Circ. 40, June 1919, 18 pp. [Received 9th October 1919].

Popular information is given with regard to damage by, and remedial measures against the most common tomato pests and diseases.

CHITTENDEN (F. H.) **The Striped Cucumber Beetle and its Control.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 1038, May 1919, 19 pp., 15 figs. [Received 9th October 1919.]

Diabrotica vittata, F. (striped cucumber beetle) is one of the most serious pests of Cucurbitaceae in the United States. In addition to the direct injury to the plants caused by the larvae and adults, the beetles are responsible for the spread of *Bacillus tracheiphilus*, the bacterial wilt infesting these plants.

The bulk of the information here given with regard to *D. vittata* has been noticed elsewhere [see this *Review*, Ser. A, v, pp. 370, 529 and vi, p. 459.].

Its natural enemies include the Tachinid flies, *Celatoria diabroticae*, Shimer, and *Chaetophleps setosa*, Coq.; the predatory bugs, *Sinea diadema*, F., *Perillus bioculatus*, F., and *Nabis ferus*, L.; and a Carabid beetle, *Pterostichus lucublandus*, Say. A mite, *Uropoda* sp., especially infests this beetle on plants grown under glass. A fungus, *Metarrhizium anisopliae*, attacks the adults and *Beauveria globulifera* the larvae. A list of birds that devour these beetles is also given.

JARVIS (E.). **Insect Pests of the Rosella.**—*Queensland Agric. Jl., Brisbane*, xii, no. 2, August 1919, pp. 69–74, 1 plate.

The Chrysomelid beetle, *Nisotra breweri*, of which the native food-plant in Queensland is *Commersonia echinata*, has now become a pest of the imported Jamaica sorrel or roselle (*Hibiscus sabdariffa*). The eggs are deposited in damp soil at a depth varying from ¼ to ½ an inch either singly or in batches of from two to eight. These hatched in about eight or ten days in cages. If exposed to the air they shrivel after seven days, and in direct sunlight at a temperature of about 106° F. they are killed in about 3 hours. The adults oviposit freely when placed in cages. Under field conditions an average of about 5 eggs a day are deposited during April, but during the cooler weather of May only half this number is laid. Each beetle deposits about 270 eggs. In captivity the oviposition period covered 68 days. The larvae and pupae may be found in the soil close to the infested plants; the former probably subsist on the roots. This pest damages the plant by eating the bark of the young shoots, sometimes completely girdling the stem. The injury thus caused encourages the growth of fungoid diseases. Leaves of the plant are also attacked by the adults.

The beetles may be collected by shaking the bushes over tarred screens. The ground around the plants should be hoed at intervals to a depth of about 2 in. to expose the eggs and larvae to the air and to predaceous enemies such as *Pheidole megacephala* and other ants.

Other insect pests of *H. sabdariffa* in Queensland include: a Lagriid, *Lagria cyanea*, Macl., a Chrysomelid, *Rhyparida discopunctulata*, Lea, a Lymantriid, *Euproctis* sp., a Pyrrhocorid, *Dysdercus* sp., and a Pentatomid, *Agonoscelis rutilia*, F.

WILSON (H. F.). **Common Insecticides; their practical Value.**—*Wisconsin Univ. Agric. Expt. Sta., Madison*, Bull. 303, June 1919, 15 pp., 4 figs.

Recent experiments carried out to ascertain the relative value of various insecticides as such, and not as a control of any particular pest, were made on the Colorado potato beetle [*Leptinotarsa decemlineata*], sawfly larvae on willows and blister beetles. Both under field and laboratory conditions potato plants were chiefly used, as they are the main crop in Wisconsin.

Magnesium arsenate is mentioned as a new insecticide, but was not included in these tests.

Paris green apparently kills quickest, but it also has a tendency to injure foliage and to settle quickly, and its adhesive qualities are not as good as those of other insecticides. The amount recommmended is 1½ to 2 lb. to 50 U.S. gals. of water.

Hydrogen lead arsenate is the most desirable poison, as although it does not kill quite as quickly as Paris green, it adheres and spreads well on plants, causing practically no injury to the foliage. Basic lead arsenate is the safer form to use on tender plants in certain climates, but it is undesirable as a spray against insects that are not quickly affected by poison. From 2 to 2½ lb. of powder to 50 U.S. gals. of water or Bordeaux mixture is recommended against *L. decemlineata*. For codling moth [*Cydia pomonella*] and leaf-feeding insects 1 lb. to the same amount of water may be used; this proportion with the addition of 1 lb. of laundry soap to increase its adhesiveness may also be used against cabbage caterpillars and other chewing insects.

Although zinc arsenite has a toxic power nearly equal to Paris green it cannot be used for fruit trees owing to the damage caused to foliage, but it is an efficient spray for *L. decemlineata*. Used at a strength of 2 lb. of powder to 50 U.S. gals. of water or Bordeaux mixture apparently no injury is caused to potato plants.

Calcium arsenate remains in suspension nearly as well as hydrogen lead arsenate and adheres equally well under favourable conditions. In certain forms its killing power is also nearly as good as that of lead arsenate and it may be used with safety if hydrated or unslaked lime is added in equal amounts. These experiments also included the testing of several proprietary insecticides and these are classified according to their efficiency.

GENTNER (L. G.). **Control the Cabbage Worm.**—*Wisconsin Agric. Expt. Sta., Madison*, Circ. 115, May 1919, 4 pp., 3 figs. [Received 9th October 1919.]

The use of lead arsenate and calcium arsenate sprays against the cabbage butterfly [*Pieris rapae*] is advocated [see this *Review*, Ser. A, vi, p. 201]. When used in the form of a dust these poisons may be diluted with from 5 to 10 parts by weight of air-slaked lime.

HINDS (W. E.). **Cotton Worm Control.**—*Alabama Agric. Expt. Sta., Auburn*, Circ. 42, August 1919, pp. 63–67, 2 plates.

Attention is drawn to a probable outbreak of the cotton worm [*Alabama argillacea*] on cotton in Alabama during 1919. The remedial measures advocated are the use of calcium arsenate and lead arsenate

sprays, of which two or three applications for the season should completely protect the crop. [See also this *Review*, Ser. A, ii, p. 694.]

The boll weevil [*Anthonomus grandis*] may be controlled with calcium arsenate applied by means of a dust gun so as to drive the poison well through the plants. This treatment should be applied weekly and maintained as long as the cotton continues to grow and set bolls. This measure is equally effective against *A. argillacea.*

THOMAS (F. L.). **The Argentine Ant and how to control it.**—*Alabama Agric. Expt. Sta., Auburn*, Circ. 39, December 1918, pp. 55-58 [Received 10th October 1919].

The bulk of the information contained in this popular bulletin on the Argentine ant [*Iridomyrmex humilis*, Mayr] has already been noticed, especially in respect of the methods of trapping [see this *Review*, Ser. A, vi, p. 313].

The poison-bait recommended is composed of sugar 15 lb., water 7 U.S. pints, and tartaric acid ¼ oz., boiled for 30 minutes and allowed to cool. To this sodium arsenate ¾ oz., dissolved in 1 U.S. pint of hot water and well stirred, is added. This bait is rendered more attractive by the addition of 1½ lb. of honey and should remain effective for several months.

HINDS (W. E.). **Sweet Potato Root Borer** (*Cylas formicarius*, **Ol.**).—*Alabama Agric. Expt. Sta., Auburn*, Circ. 37, February 1918, 8 pp., 1 plate. [Received 10th October 1919.]

This deals in a popular manner with the bionomics and control of *Cylas formicarius*, Ol. (sweet potato weevil).

The rules and regulations of the Alabama State Board of Horticulture for preventing the introduction of this pest are given. The quarantined area is defined and includes any area where sweet potatoes are grown within five miles of any known point of infestation. Sweet potato plants or other food-plants of *C. formicarius* may not be transferred from infested territory to non-infested areas except when specially authorised; this applies also to nursery stock. These regulations took effect from 1st February 1918 and replaced those dated 8th December 1917.

TIMBERLAKE (P. H.). **Revision of the Parasitic Chalcidoid Flies of the Genera** *Homalotylus*, **Mayr, and** *Isodromus*, **Howard, with Descriptions of two closely related Genera.**—*Proc. U.S. Nat. Mus., Washington*, lvi, pp. 133-194, 4 plates.

The members of the genus *Homalotylus* are of economic interest in that they parasitise Coccinellid larvae, and two are known to attack Chrysomelid larvae.

The new species described include: *Homalotylus mexicanus* reared from material of *Ceroputo yuccae*, Coq., on agave in Mexico; *H. quaylei* reared from a Coccinellid associated with *Pseudococcus citri*, Risso, in Sicily; *H. africanus*, from Coccinellid larvae in South Africa; *H. cockerelli*, from *Hyperaspis trimaculata*, L., associated with *Dactylopius confusus*, Ckll., on *Opuntia* in Texas; *H. affinis*, from *Hyperaspis osculans*, Lec., in colonies of *D. confusus*, Ckll., in California;

H. brevicauda from a Scymnine larva associated with *Orthezia* sp. on *Hymenoclea monogyra* in Mexico; and *H. hyperaspidis*, from *Hyperaspis undulata*, Say, in Utah and California.

A new genus, *Anisotylus*, is erected with *A.* (*Homalotylus*) *similis* as the type, and *A. similis texanus*, subsp. n., from *Hyperaspis bigeminata*, Rand, and an undetermined Coccinellid larva in Texas, and *A. similis utahensis*, subsp. n., from *Scymnus americanus*, Muls., and *S. lacustris*, Lec., in Utah are described.

The species of the genus *Isodromus* all parasitise Chrysopid larvae, and at least two of them, *I. iceryae*, How., and *I. niger*, Ashm., are also known to attack Hemerobiids in the United States.

Brethesia latifrons, gen. et sp. n., was reared from material of *Icerya purchasi*, Mask., in Argentina. The actual host was probably a Chrysopid or Hemerobiid predaceous on this scale.

SANDERS (J. G.). **General Information for Nurserymen and Shippers concerning the Inspection and Transportation of Nursery Stock in the United States and Canada.**—*Pennsylvania Dept. Agric., Bur. Econ. Zool., Harrisburg*, Circ. 7, January 1919, 22 pp. [Received 13th October 1919.]

Short summaries are here given of the laws of different States in North America, governing the inspection and transportation, etc., of nursery stock, compiled under the name of each State as an easy reference for nurserymen and shippers.

MAHEUX (G.). **De la Protection des Plantes.**—*Minist. Agric. Prov. Quebec*, Bull. 42, May 1918, 30 pp., 36 figs. [Received 14th October 1919.]

A brief and popular account is given of the most common pests of Quebec, arranged under the headings of crops attacked. The usual remedial measures are described and formulae for various insecticides and fungicides are given. The text of the law of 1914 for the protection of plants against noxious insects and diseases is appended. This includes the prohibition during blossoming of the use of poison-sprays that are toxic to bees.

MAHEUX (G.). **Rapport de la Section Entomologique.**—*Rapport Ministre Agric. Prov. Quebec, Quebec*, 1917, pp. 141–144. [Received 14th October 1919.]

During nursery inspections in the year ended 30th June 1917, few insect attacks of importance were observed. *Eriosoma* (*Schizoneura*) *lanigerum* (woolly apple aphis) occurred abundantly in a few localities and threatened to become unusually plentiful in the following summer. Great efforts have been made to keep the Province free from invasion by *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorroea*, L.) (brown-tail moth) which causes such ravages in the United States. Each year thousands of parasitic and predaceous insects are liberated along the frontier, thus forming a natural barrier between the infested and non-infested regions. A severe infestation of *Agrotis* (*Noctua*) *fennica*, Tausch., occurred in one locality, all vegetation within an area of about 15 acres being devoured by this cutworm.

The organisation of the entomological section is explained. Attempts have been made to popularise scientific knowledge for the use of agriculturalists and growers by means of articles in the daily papers and by the publication of special bulletins.

MAHEUX (G.). **Report of the Provincial Entomologist.**—*Report Minist. Agric. Prov. Quebec, Quebec,* 1918, pp. 86–90. [Received 14th October 1919.]

Insect pests of vegetables during the year 1917–1918 included the usual enemies of kitchen-gardens. Isolated attacks occurred of *Phorbia fusciceps*, Zett., on young beans, *Bruchus pisorum*, L. (pea weevil), *Psila rosae*, L. (carrot fly), *Ceramica (Mamestra) picta*, Harr. (zebra caterpillar) and *Crioceris asparagi*, L. (asparagus beetle). Measures were taken against *Agrotis (Noctua) fennica*, Tausch. (black army worm), mentioned in the preceding report as having done considerable damage, and another cutworm, *Hadena devastatrix*, Brace, which destroyed large fields of cereals in another locality.

Fruit pests included *Aphis mali*, F. (green aphis), *Cydia (Carpocapsa) pomonella*, L. (codling moth), and *Hemerocampa leucostigma*, S. & A. (white-marked tussock moth). Gooseberry and currant bushes were attacked by *Pteronus ribesii*, Scop. (currant sawfly) and an Aphid, *Myzus ribis*, L.

CHAPAIS (J. C.). **The Pepper and Salt Moth,** *Amphidasis cognataria*, **Gn.**—*11th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fungous Diseases, 1918–1919*; *Quebec,* 1919, pp. 25–26. [Received 14th October 1919.]

Some account is given of the Geometrid, *Amphidasis cognataria*, Gn., which the author has found feeding on plum trees, currant bushes and on sweet clover, *Melilotus alba*. Slingerland and Crosby's description of the insect and its life-history are quoted. Arsenical poisons are successful in keeping this moth in check.

PETCH (C. E.). **Dusting and Spraying Suggestions for Quebec.**—*11th Ann. Rept. Quebec. Soc. Prot. Plants from Insects and Fungous Diseases, 1918–1919*; *Quebec,* 1919, pp. 27–28. [Received 14th October 1919.]

There is considerable difference of opinion as to whether calcium arsenate is a safe insecticide to use with lime-sulphur. The author's experience has been that ¾ lb. used with 40 gals. diluted lime-sulphur does not cause any injury. It has also been used at a strength of 10 per cent. as a dust mixture with equal parts of sulphur and talc. With Bordeaux mixture on potatoes it is superior to Paris green or lead arsenate. It cannot, however, be used alone. It is proposed to test this substance over a period of five years and compare it with lead arsenate. High grade calcium hydrated lime is recommended as superior to stone or quick lime for insecticidal purposes.

Dust spraying proved almost doubly as expensive as the use of liquids, but both methods have produced perfect fruit and foliage. It is thought that when the cost of dusting has been reduced and experience has produced better mixtures, dusting will become far

more popular. The folly of adopting spray calendars drawn up for use in other localities is pointed out; local conditions should be studied and the most suitable spraying system should then be developed, since insects and diseases vary with the season and the locality.

McLaine (L. S.). **The Present Situation of the Brown-tail Moth in Eastern Canada.**—*11th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Funguos Diseases, 1918–1919*; *Quebec*, 1919, pp. 29–32, 4 figs. [Received 14th October 1919.]

While the province of Quebec has not yet been invaded by the brown-tail moth [*Nygmia phaeorrhoea*, Don.], it is necessary to scout and inspect the localities in close proximity to infested areas, the insect being in some case no more than 20 miles from Quebec. An open country such as Quebec, which contains many favourite food-plants of this moth, such as cultivated and wild apple, wild cherry, thorns and *Amelanchier*, would offer every encouragement to its spread.

In New Brunswick, no nests of *N. phaeorrhoea* were discovered in 1918–1919, this being the first time the province has been free from the pest since 1910. The outbreaks are, however, more or less epidemic in character and, under favourable meteorological conditions, are likely to recur. Nests undoubtedly remain undiscovered under the snow throughout the winter, the mortality in these being very low, and these are responsible for maintaining an infestation which otherwise would be exterminated.

In Nova Scotia, the pest was already established and spreading before the Canadian Government took over the control work. The climate is mild and favourable, and food-plants are much more abundant, with the result that three examinations are necessary in some localities, while in New Brunswick only one is made. In two localities where thorn was heavily infested, hand-picking was impracticable; these areas were sprayed with oil and burned over. The results were excellent in both cases. Although there has been a gradual reduction in the number of nests collected in Nova Scotia during the past few years, the brown-tail moth is still breeding extensively, and vigorous campaigns are necessary to keep it in check.

The work of rearing parasites at Massachusetts has continued for four years, over 100,000 parasites being imported into Canada. The Braconid, *Apanteles lacteicolor*, Vier., has been recovered in New Brunswick and Nova Scotia. The Tachinid, *Compsilura concinnata*, Meig., has been liberated in Quebec, New Brunswick and Nova Scotia, where its hosts are *Hemerocampa leucostigma*, *Vanessa* (*Euvanessa*) *antiopa*, *Datana ministra* and *Pieris* (*Pontia*) *rapae*. The predaceous beetle, *Calosoma sycophanta*, has also been liberated in Quebec, New Brunswick, and Nova Scotia.

Hutchings (C. B.). **The Imported Leaf Miner.**—*11th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fungous Diseases, 1918–1919*; *Quebec*, 1919, pp. 35–37, 6 figs. [Received 14th October 1919.]

Kaliosysphinga dohrni, Tischb. (alder leaf-miner) has been causing severe damage at the experiment farm at Ottawa to a fine collection of alder trees, the leaves of which are disfigured by large brown

blisters. This sawfly appears in late May or early June and oviposits through slits in the upper surface of the leaf. The eggs hatch in about 8 days and the young larvae begin to construct individual mines in the leaves; these later become joined up with other mines until the entire parenchyma of the leaf is eaten out and the upper surface is brown and badly blistered. After feeding for about three weeks the mature larva drops to the ground, enters the soil to the depth of about one inch and there constructs a cocoon in which it pupates, the adult emerging about 3 weeks later. There are two generations in a year, with sometimes a partial third, the broods overlapping.

Natural control seems to be exercised to a certain extent by a species of mite and by a Hymenopterous parasite. Many of the adults have been observed caught in spider webs, while many appear to become imprisoned in their cocoons and never reach the surface of the ground. Artificial control has been tried by means of several contact insecticides, the best of which was 1 part kerosene emulsion to 5 parts water, which killed practically all the larvae if applied when they were young; when they have just hatched, 1 part kerosene emulsion to 7 of water is effective. Certain species of alder seem to be immune to attack by *K. dohrni*, probably owing to the thick and hard texture of the leaves.

SWAINE (J. M.). **Some Insect Injuries in Woodlots.**—*11th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fungous Diseases, 1918–1919*; *Quebec*, 1919, pp. 46–48, 6 figs. [Received 14th October 1919.]

Insect injuries to balsam and spruce in Quebec are described, particularly in regard to the insects infesting farm wood-lots. These have undoubtedly arisen largely in consequence of the great outbreak of the spruce bud-worm [*Tortrix fumiferana*] that occurred in the western half of the Province several years ago [see this *Review*, Ser. A, vii, p. 299]. Particular injuries dealt with are those caused by the eastern balsam bark-beetle, *Pityokteines sparsus*, Lec., erroneously referred to in a previous notice [*loc. cit.*] as *Ips balsameus*, Lec., and by the eastern balsam bark-weevil, *Pissodes dubius*, Rand. The eggs of the latter are laid in early summer in small punctures cut in the bark of the trunk of healthy or weakened balsams. The egg-punctures are arranged in groups and form conspicuous patches owing to the dried balsam that exudes from the tree. The larvae excavate long winding mines between the bark and wood. The young beetles, after maturing in the end of the larval mines, emerge through the bark early in the following season. The injury to young balsam has been extensive and spruce is suffering in a less degree from similar causes.

The bronze birch borer [*Agrilus anxius*] caused the death of many white and yellow birches in the summer of 1918. The infested trees die gradually from the top downwards. By the time the top of the tree is dead, the grubs are constructing their tunnels in the apparently healthy bark below, and cutting off the tree top generally only checks the attack temporarily. All trees found infested should be cut and utilised the same winter. Destruction of infested trees before June will check the spread of the beetles.

Du Porte (E. M.). **Insect Carriers of Plant Diseases.**—*11th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fungous Diseases, 1918–1919*; *Quebec*, 1919, pp. 59–65.

There are many ways in which disease may be spread among plants through the agency of insects, and there is a general similarity between these and those by which disease is carried by insects among men and animals. This paper summarises much of the present knowledge on this subject. The question is raised whether the same organism can normally attack both an animal and a vegetable host; investigations up to the present have given mostly negative results. An exception, however, is the causal organism of the bud-rot disease of the coconut, a bacillus indistinguishable from *Bacillus coli*, which lives in the intestines of man and other animals. *Ophionectria coccicola*, a fungus infesting scale-insects, has been known to pass from scales to orange twigs, causing gummosis. A case in which the evidence indicates that an insect may serve as host of an organism normally parasitic on plants is that of the beet leaf-hopper, *Eutettix tenella*, which spreads curly-leaf disease of beets in the south-western states. Investigations have shown the necessity of an incubation period in the body of the insects before they can transmit the disease [see this *Review*, Ser. A, v, p. 492], and they are therefore not merely mechanical inoculators.

Among the insects that have been proved responsible for the spread of fire-blight (*Bacillus amylovorus*) are various Rhynchota, such as *Aphis pomi*, deG., *Lygus pratensis*, L., *Adelphocoris rapidus*, Say, *Campylomma verbasci*, H.S., *Orthotylus flavosparsus*, Sahlb., and *Poeciloscytus basalis*, Reut., while any sucking insect feeding on infected trees is a potential carrier. The European apple-tree canker (*Nectria ditissima*) is often spread by means of Aphids. Boring insects that transmit disease include the fruit bark-beetle, *Scolytus* (*Eccoptogaster*) *rugulosus*, which is a carrier of fire-blight, and the Longicorn, *Leptostylus macula*, which carries the chestnut blight fungus, *Endothia parasitica*. Leaf-eating insects may convey disease organisms on their bodies and introduce them into the tissues on which they feed. In this way *Diabrotica vittata* (striped cucumber beetle) causes the spread of bacterial wilt of cucurbits (*Bacillus tracheiphilus*), *D. duodecimpunctata* being a carrier of secondary importance. The larvae of *Phytometra* (*Plusia*) sp. disseminates black rot of crucifers, and *Leptinotarsa decemlineata* (potato beetle) the brown rot of Solanaceous plants.

Indirect inoculation may take place, owing to the presence of wounds on the trees, depending largely on the ability of the virus to enter through stomata or water-pores or to pierce the epidermis: such a case is instanced in the spread of fireblight by bees and flies. The numerous wounds made by insects in plants greatly increase the chances of infection, *e.g.*, egg-punctures of *Oecanthus nigricornis* (striped tree-cricket) in raspberry canes encourage the growth of the blight, *Leptosphaeria coniothyrium*, while in apple the punctures of *O. niveus* (snowy tree-cricket) encourage the same disease. Curculionids make punctures through which brown rot fungus can enter, and various cane borers encourage the *Trichosphaeria* disease of sugar-cane.

The possibility of hibernating insects remaining infective throughout the winter has received considerable attention, and it has been found

that *Diabrotica vittata* retains the organism of cucurbit wilt in a viable condition for at least six weeks when the insect is placed in cold storage. Attempts to recover the spores of late blight from hibernated individuals of *L. decemlineata* have not as yet been successful.

A consideration of these facts makes it evident that many fungous diseases can be more effectively controlled by insecticides than by fungicides. For example, young apple seedlings in one nursery that were constantly dipped in kerosene emulsion and thus kept free from Aphids were free from blight disease, while in surrounding nurseries it was very prevalent.

LOCHHEAD (W.). **Some Common Things on the Farm.**—*11th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fungous Diseases, 1918-1919; Quebec,* 1919, pp. 66–71, 9 figs. [Received 14th October 1919.]

This paper is a synopsis of an illustrated address given to teachers, children and parents, dealing with the more common insect pests, fungous diseases, weeds, etc.

DENDY (A.) & ELKINGTON (H. D.). **On the Prevention of Heating in Wheat by Means of Air-tight Storage.**—*Rept. Grain Pests (War) Committee, Royal Society, London,* no. 5, July 1919, 10 pp., 2 figs. [Received 15th October 1919.]

With reference to the efficacy of airtight storage for dealing with infested grain [see this *Review*, Ser. A, vii, p. 94] the possibility of the process known as "heating" under these circumstances has been the object of recent experiments. Previous literature on the same subject is reviewed.

These observations show that not only does "heating" not take place under airtight conditions, but this treatment also prevents the growth of moulds, even in the presence of excess of moisture. The experiments were carried out on small quantities in thermos flasks, and owing to the purposely exaggerated moisture the wheat became acid. This may impair its milling value, but there are no grounds for believing that this acidity could develop in normally dry wheat under similar conditions. The limit of safety as regards moisture for wheat intended for prolonged treatment requires further investigation on a larger scale. The temperature charts given present two distinct maxima, suggesting the presence of two distinct processes of fermentation. The first is due to enzymes in the grain itself, whilst the second may be due to microbic fermentation resulting in the rotting of the wheat.

DESLANDES (E. A.). **Entomologia para Uso das Escolas Agricolas do Brazil.**—*Lavras, Minas,* 1919, 2nd edition, 66 pp.

This little book aims at giving elementary instruction in entomology. The first part deals with the anatomy and physiology of insects, and the second with taxonomy. The collection and destruction of injurious insects is the subject of a special chapter.

Gang und Stand der Schweizerischen Landwirtschaft im Erntejahr 1917.—[Swiss Agriculture in 1917.]—*Landwirtschftl. Jahrbuch d. Schweiz, Berne,* xxxiii, no. 2, 1919, pp. 82–99.

Apple trees were injured by *Anthonomus* [*pomorum*] and stone-fruits by *Hyponomeuta*. Injury by *Cheimatobia* [*brumata*] was less pronounced. The vine-moths [*Clysia ambiguella* and *Polychrosis botrana*] appeared later than in other years and were not very harmful. Owing partly to comparatively late sowing, oats suffered considerably from the attacks of the frit-fly [*Oscinella frit*], so that in some localities the fields had to be ploughed up.

Ballou (H. A.). **Report on Cacao Thrips, etc. in Grenada.**—*Rept. to the Governor of the Windward Islands, Grenada,* 7th February 1919, pp. 2–14. [Received 15th October 1919.]

The object of the investigations recorded in this paper was to examine cacao plantations in Grenada suffering from attacks of the cacao thrips [*Heliothrips rubrocinctus*] with special reference to the value of spraying. The conditions with regard to thrips were much the same as in previous years, though there has been some change in the local incidence of this pest. On the whole, the south and west of Grenada appear to offer the most favourable conditions for thrips. It is expected that the cacao crop of 1919 will be a small one, which is only to be expected after the unusually large crops of the previous years. The lack of commercial fertilisers is also considered to be to some extent responsible for the shortage of the present crop.

The cultivation practised on cacao estates in Grenada is on the whole very good, and still improving, more attention being given to the construction of drains, and to the extensive use of manure, mulch and soil covers. The connection between shade and drainage is discussed, the cacao plants as a rule requiring more drainage when provided with less shade, for if the growing roots are exposed under a thin covering of soil to the hot sun without a sufficient supply of moisture, serious injury will result. Probably this is the explanation of the frequently expressed opinion that attacks of thrips occur only in cacao with a western aspect. Plantains, beans and other cover plants are frequently used on exposed patches of soil.

The practice of spraying cacao has been revived only since 1916. Bordeaux mixture with Blackleaf 40 is considered more lasting in its effect than soap and nicotine; both mixtures kill a high percentage of the thrips, but re-infestation occurs within a short time. There are at present no figures available to show the amount of damage done by thrips, but in some cases there is undoubtedly a considerable loss of crop and some trees have died.

It is considered very desirable that experiments should be undertaken to determine the conditions that lead to outbreaks of thrips in certain localities. In the author's opinion, injurious attacks of thrips are entirely secondary and dependent upon some entirely physiological condition in the plant [see this *Review*, Ser. A, iii, p. 582]. This would explain the fact that many trees remain perfectly healthy although thrips are present all the time. It is recognised by most cacao planters that cultural methods are necessary in every attack of thrips;

in fact by many, such remedies are considered more valuable than spraying. It would be a great advantage if certain thrips-infested areas of cacao could be kept under observation for a period of years and experiments made to compare the value of certain cultural methods and of spraying.

Weather conditions appear to have a considerable influence on the abundance of thrips. If during the normally dry season (February to May or June) there are frequent showers, thrips are likely to be more numerous: the reason for this is not definitely known. The processes of draining, bedding, forking and the use of mulches and manures are discussed. It is suggested that in certain localities where drainage is ample and yet thrips persist, a few, perhaps one in four, of these drains should be filled in by making a layer of stones 6 to 8 in. deep at the bottom and then filling up to the ground level with leaves, bush, manure, and any organic matter that would rot and assist the growth of the roots. These would continue their function as drains for some time, and before they became useless as drains the trees should have made such vigorous growth and increased their yield sufficiently to pay for the construction of new drains if necessary. On estates where the soil is thin a constant cover of mulch should be maintained, composed of any organic matter and laid perhaps half knee deep.

The cacao beetle [*Stirastoma depressum*, L.] is confined almost entirely to the leeward side of the Island. It is suggested that trapping the beetles, which has proved successful in Trinidad [see this *Review*, Ser. A, i, p. 122, etc.], should be more generally practised. The mealy bug [*Pseudococcus citri*] and the black or acrobat ant [*Cremastogaster* sp.] are still prevalent in some localities [see this *Review*, Ser. A, iii, p. 583]; for the former, a wash containing 5 lb. Scalo and ½ lb. Blackleaf 40 to 100 gals. water is a satisfactory insecticide, and should also be effective against the ants, provided that all the nests on the trees are exposed before spraying.

WILLIAMS (C. B.). **Sugar-Cane Varieties and Froghopper Blight in Trinidad.**—*Bull. Dept. Agric. Trinidad and Tobago, Port-of-Spain*, xviii, no. 2, 8th September 1919, pp. 70–83.

The different varieties of sugar-cane grown in Trinidad are discussed as regards their relative immunity to frog-hopper blight. Although no variety was found to be totally immune, resistance varies considerably and is also influenced by the soil and climatic conditions.

URICH (F. W.). **Control of the Cacao Thrips in Trinidad and Tobago.**—*Bull. Dept. Agric. Trinidad and Tobago, Port-of-Spain*, xviii, no. 2, 8th September 1919, pp. 84–97, 16 figs.

A popular description is given of the life-history, damage by and remedial measures against the cacao thrips [*Heliothrips rubrocinctus*]. The bulk of the information given has been noticed elsewhere [see this *Review*, Ser. A, vi, p. 496, etc.].

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. Dominica 1918–19, Barbados*, 30th August 1919, pp. 13–15.

A Longicorn, *Leptostylus praemorsus* (lime-tree bark-borer), has been found in freshly killed lime trees in Dominica. This beetle apparently completes its life-cycle in dead wood, and although it has little influence on healthy tissue, it hastens the death of diseased trees. Clean cultivation is the most important remedial measure. Dead patches should be cleaned and smeared with tar.

Attention is called to the fact that though *Aleurocanthus woglumi* (black fly of citrus) is not present on the island, it may be introduced at any time in spite of the precautions taken to prevent this.

Vayssière (P.). **La Lutte contre le Criquet pélerin en Afrique.**—*Jl. d'Agric. Trop., Paris*, xix, no. 161, 30th September 1919, pp. 305–307.

Much of the information contained in this paper on locusts has already been noticed [see this *Review*, Ser., A, vii, p. 432].

Vayssière (P.). **L'Etude des Ennemis des Plantes aux Colonies.**—*Jl. d'Agric. Trop., Paris*, xix, no. 161, 30th September 1919, pp. 320–321.

Attention is drawn to the necessity of forming some organisation throughout the French colonies to deal with the insect and fungus pests affecting economic plants. Similar organisations existing in other countries are quoted as examples.

Bazile (G.). **Nouveaux Procédés de Destruction des Acridiens.**—*C. R. Hebdom. Acad. Sci., Paris*, clxix, no. 12, 22nd September 1919, pp. 547–549.

The campaign against locusts in question has been previously noticed [see this *Review*, Ser, A, vii, p. 432]. Similar experiments were carried out in Algeria, where the value of flame-throwers as a means of destroying *Schistocerca tatarica* was confirmed. Spraying with 25 lb. heavy coal-oil to 5 lb. of black soap and 47 gals. of water is recommended where the burning of trees is not advisable. Carbon oxychloride and tin chloride were tested but did not prove successful.

Froggatt (W. W.). **The Native Lime Tree Borer** (*Citriphaga mixta*, **Lea**).—*Agric. Gaz. N. S. W., Sydney*, xxx, no. 4, 2nd April 1919, pp. 261–267, 4 figs. [Received 20th October 1919.]

During 1918 a Longicorn beetle was found attacking "native lime" trees (*Atlantia glauca*) in New South Wales. A new genus, *Citriphaga*, has been erected for its reception by Lea, whose description of the species is appended.

The eggs of *C. mixta* are laid in the bark a few inches above the ground. The larvae bore up the stem for about 4 or 5 feet, causing gumming of the damaged wood. Several larvae may work side by side, thus riddling the whole stem. The duration of the larval stage is about 10 months and that of the pupa from 4 to 6 weeks. It is not unlikely that *C. mixta* may attack cultivated *Citrus* trees.

ESAM (G.). Control of Red Mite and Woolly Aphis in Nursery Stock.—*New Zealand Jl. Agric., Wellington*, xix, no. 2, 20th August 1919, pp. 94–96.

Experiments made to ascertain a cheap but effective spray against red mite [*Tetranychus*] and woolly aphis [*Eriosoma lanigerum*] are here described, and the results show that lime-sulphur is as effective against *Tetranychus* as Blackleaf 40, but that the latter is essential where woolly aphis is present. Spraying for red mite should be carried out soon after the first mites hatch from the summer eggs and before the winter eggs are laid. For this purpose three applications in October have proved efficacious in New Zealand, but further observations are being made to confirm this. This treatment is equally well suited to orchard and nursery stock.

WEISS (H. B.). Notes on *Gargaphia tiliae*, Walsh, the Linden Lace-Bug.—*Proc. Biol. Soc. Washington, D.C.*, xxxii, no. 33, 30th September 1919, pp. 165–168.

During 1918 and 1919 the lace-bug, *Gargaphia tiliae*, Walsh, was very abundant in Philadelphia. The egg and 5 nymphal stages are described. The eggs are inserted in clusters in the lower leaf surface of limes about the end of May or beginning of June, soon after the appearance of the adults. They hatch in about a week and the nymphs, which feed on any part of the leaf, are carefully guarded by the female. The combined nymphal stages last about 3 weeks. The adults of the first brood appear during the end of June and beginning of July, after which eggs are again laid; the second generation hibernates in the adult form and reappears in the following spring.

RUMSEY (W. E.). Biennial Report of the State Entomologist, July 1st 1916–June 30th 1918.—*3rd Bienn. Rept. W. Virginia Dept. Agric., Charleston*, 1917–18, pp. 43–56, 5 figs. [Received 21st October 1919.]

In the southern counties of West Virginia the San José scale [*Aspidiotus perniciosus*] caused considerable damage to peach trees in 1917. Instructions were given with regard to spraying against this pest, and spraying demonstrations also included measures against codling moth [*Cydia pomonella*] and plum curculio [*Conotrachelus nenuphar*].

A scale, *Chionaspis salicis*, was intercepted on lilac from Holland.

RUMSEY (W. E.). The Periodical Cicada or so-called Seventeen-year Locust in West Virginia 1919.—*West Virginia Dept. Agric., Charleston*, November 1918, Bull. 37, 8 pp., 1 plate, 3 figs. [Received 21st October 1919.]

A list is given of the counties in West Virginia in which brood x of the periodical cicada [*Tibicen septemdecim*] was expected to appear in the spring of 1919. The life-history and remedial measures are described [see this *Review*, Ser. A, v, p. 369, and vii, p. 381]. The natural enemies include a large digger wasp, pigs, poultry, birds and various wild animals, which devour both the mature nymphs and adults. The next brood is expected in 1923.

Destruction of Agricultural Pests.—*Ann. Rept. Director of Agric. 1918-19, Nicosia, Cyprus,* 1919, pp. 16-17. [Received 21st October 1919.]

Although attacks by the vine sirividhi [*Zygaena ampelophaga*] were less numerous than in the previous year, the campaigns against this pest and also against codling moth [*Cydia pomonella*] were continued in 1918. Systematic measures against *Eurytoma amygdali*, a Chalcid infesting almonds, were undertaken during July, August and September, including the collection of fallen infested almonds and their destruction. *Phthorimaea operculella* (*Lita solanella*) was found damaging potatoes. Over 8,000 apricot and Kaisha trees were attacked by larvae of an unidentified Tineid moth.

CARPENTER (P. H.) & ANDREWS (E. A.). **Report on Tea Mosquito Blight.**—*Planters' Chronicle, Bangalore,* xiv, no. 38, 20th September 1919, pp. 634-639.

Further investigations have been made with regard to the determination of the factors governing infestation of tea in India by the tea mosquito [*Helopeltis theivora*], [see this *Review*, Ser. A, ii, p. 430]. All observations show that healthy plants suffer comparatively little, and as their vigour depends chiefly on soil conditions [*loc. cit.*, vi, p. 314], these and climatic conditions are indirectly responsible for the amount of infestation. Various suggestions are made for improving water-logged soil, as excess of soil humidity encourages infestation by impoverishing the plants. The numerous sprays tried have not proved successful, but these experiments are being continued. Formalin has been found effective, but only at a strength that causes scorching of the foliage.

El Algodonero en Colombia.—*Revista Agricola, Bogotá,* iv, nos. 5, 8 & 9, May, August & September 1918, pp. 263-270, 503-512 & 551-567, 6 figs. [Received 21st October 1919.]

In the course of this paper on cotton cultivation in Colombia, some account is given of the insect pests of this plant, including *Anthonomus grandis*, which has not yet appeared in Colombia; *Heliothis varia* [? *obsoleta*], a Noctuid commonly found in all cotton-growing regions, including Colombia, and causing much damage in the larval stage; *Alabama* (*Aletia*) *argillacea*, which is found in most Colombian plantations of tobacco, cotton, maize and tomatoes, the larvae eating the young, tender leaves and flowers.

Minor pests include a beetle, *Ataxia crypta*, which oviposits in the young shoots, and a cotton-stainer, *Dysdercus suturellus*, which is abundant in cotton plantations in low-lying districts. General methods of control are discussed for these insects, and the importance of protecting insectivorous birds and mammals is emphasised.

BEESON (C. F. C.). **The Food Plants of Indian Forest Insects. Part IV.**—*Indian Forester, Allahabad,* xlv, no. 9, 15th September 1919, pp. 488-495.

This continuation of lists previously noticed [see this *Review*, Ser. A, vii, p. 403] includes the **Lamiids**: *Apriona cinerea*, Chev., on

Morus indica; *A. germari*, Hope, on *Ficus infectoria*, *Morus indica*, *M. alba* and *Broussonetia papyrifera*; *A. rugicollis*, Chev., on *Morus alba*: *Batocera albofasciata*, DeG., on *Castilloa elastica*, *Erythrina indica*, *Ficus elastica* and *F. hispida*; *B. roylei*, Hope, on *Mangifera indica*: *B. rubus*, L., on *Albizzia lebbek*, *Hevea braziliensis*, *Moringa pterygosperma*, *Bombax malabaricum*, *Erythrina indica*, *Ficus carica*, *F. elastica*. *F. glomerata* and *Mangifera indica*; *B. titana*, Thoms., on *Mangifera indica*; *Coelosterna scabrator*, F., on *Casuarina equisetifolia*. *Shorea robusta* and *Acacia arabica*; *C. spinator*, F., on *Pyrus malus*, *Rosa* sp., *Acacia arabica*, *Casuarina equisetifolia* and *Zizyphus jujuba*; *Dihammus fistulator*, Germ., on *Coffea* sp., *Ficus elastica* and *Theobroma cacao*: *Epepeotes luscus*, F., on *Artocarpus integrifolia*, *Castilloa elastica*. *Ficus hispida*, *Mangifera indica* and *Theobroma cacao*; *E. uncinatus*, Gah., on *Ficus elastica*; *Glenea galathea*, Thoms., on *Gmelina arborea* and *Tectona grandis*; *G. indiana*, Thoms., on *Tectona grandis*: *G. quatuordecim-maculata*, Hope, on *Pinus excelsa* and *P. longifolia*; *G. spilota*, Thoms., on *Bombax malabaricum*; *Haplohammus cervinus*, Hope, on *Tectona grandis*; *H. punctifrons*, Gah., on *Ficus elastica*; *Mecotagus tigrinus*, Oliv., on *Ficus elastica*; *Moechotypa verrucicollis*, Gah., on *Hevea braziliensis*; *Monochamus bimaculatus*, Gah., on *Dalbergia sissoo*; *Nupserha variabilis*, Gah., on *Tectona grandis*: *Sthenias grisator*, F., on *Chloroxylon swietenia*, *Erythrina indica*, *Morus alba*, *Nerium odorum*, *Rosa* spp., *Tabernaemontana alba* and *Vitis vinifera*.

The Lucanids: *Cladognathus giraffa*, F., on *Picea morinda* and *Quercus* sp.; *Dorcus antaeus*, Hope, on *Quercus incana*: *Hemisodorcus nepalensis*, Hope, on *Cedrus deodora* and *Quercus* sp.; *Lucanus lunifer*, Hope, on *Machylus* sp., *Quercus dilatata* and *Q. incana*; *Prosopocoelus bulla*, Hope, on *Picea morinda*.

The Passalids: *Leptaulax dentatus*, F., on *Bombax malabaricum*, *Ficus elastica* and *Shorea robusta*: *Tiberioides kuwerti*, Arrow, on *Juglans regia*.

PAOLI (G.). **Notizie sulla Lotta contro le Cavallette nella Provincia di Foggia nel 1919 e su Proposte di nuovi Metodi.** [Notes on anti-Locust Work in the Province of Foggia in 1919 and on Suggestions for new Methods.]—Separate from *La Propaganda agricola e l'Agricoltura pugliese*, *Bari*, Ser. 2, xi, no. 15, 15th August 1919, 5 pp.

In 1919 *Dociostaurus maroccanus* was again abundant in the province of Foggia and as in the previous year the measures used were spraying with sodium arsenite (0·75–2 per cent.) and spreading bran that had absorbed nearly its own weight of sodium arsenite solution 1·6 per cent. The bran was treated in an apparatus consisting of a tray with a perforated bottom through which the bran falls into a truck, owing to the to-and-fro motion of the tray on rails with a milled surface. During its fall it is sprayed with the poison from a series of fine jets. About 70 tons of bran were used. An experiment was made with zinc phosphide dusted on the grass by means of insecticide bellows as used in vineyards, and this method appears to be promising, though the trial was not quite successful owing to the coarseness of the powder and the late date of application, the grass being withered and no dew

being on it in the morning. Zinc phosphide has not been commonly used as an insecticide; it is said to give good results against cockroaches. A method suggested, but which could not be tested, was crushing the locusts with a farm tractor with wide-flanged wheels.

GIRAULT (A. A.). **Javanese Chalcid-Flies.**—*Treubia, Batavia*, i, no. 2, August 1919, pp. 53-59.

The following are among the species recorded: *Coccophagus tristis*, Zehnt., reared from pupae of *Aleurodes bergi* on sugar-cane at Gordonvale, Queensland, and new to the Australian fauna: *Philotrypesis javae*, sp. n., from fruits of a wild *Ficus* in Central Java; *Anastatus locustae*, sp. n., from Locustid eggs in twigs of *Coffea robusta* in Eastern Java; and *Neocatolaccus vandinei*, Tucker, infesting *Pachymerus* sp. in Java.

ROEPKE (W.). *Xyleborus destruens*, **Bldfd. (Col. Ipidae), schädlich für Djati** (*Tectona grandis*). [*Xyleborus destruens* injurious to Teak.]—*Treubia, Batavia*, i, no. 2, August 1919, pp. 68-71, 16 figs.

The Scolytid beetle, *Xyleborus destruens*, Bldfd., is common in Java in old cacao plantations, where it abounds in old stems attacked by canker. From the numerous bore-holes in the diseased tissues cords of whitish, loosely-packed frass protrude. Until recently diseased cacao trees were the only plants attacked, so that the injury was of little economic importance, but *X. destruens* has now been observed on young teak trees in Central Java, its habits there being very different from those hitherto recorded. As Blandford's description is incomplete both sexes of this beetle are re-described.

ROEPKE (W.). *Hyalopeplus smaragdinus*, **n. sp., eine neue Thee-Capside aus Java (Rhynch.: Hem. Heteropt.).**—*Treubia, Batavia*, i, no. 2, August 1919, pp. 73-81, 5 figs.

A Capsid bug received in August 1918 from a tea estate near Soekaboemi, Java, is described as *Hyalopeplus smaragdinus*, sp. n., and *H. smaragdinus* f. *rubinus*, n., is described from a female received in November 1918 from the neighbourhood of Buitenzorg. The differences between this species and *Callicratides rama*, Kirby, which occurs on tea in Ceylon and belongs to a genus which has been held to be synonymous with *Hyalopeplus* by O. M. Reuter, are noted. A note at the end of this paper states that another female recently received appears to be *H. citripennis*, Stål.

During its entire development the bug lives in the flower-buds of the tea plant, being found in young buds as well as in those about to open. It bores with it proboscis into the closed perianth until the point penetrates one of the pollen sacs, which is sucked out. The tissue around the puncture is not discoloured and the injury seems limited to a few anthers, so that the development of the bud should not be prevented; this point, however, requires further investigation. In captivity the bugs refused to feed on any other part of the plants, even very tender tea-shoots being rejected. As tea is not native

... Java these Capsids must have wild food-plants, possibly *Shima* ..., a Ternstroemiaceous plant with leaves resembling those ... tea. The eggs are laid in the tea flower-bud, and this must injure ... bud more than the puncture does. Two parasites, a Chalcid and a Proctotrupid, were reared from the eggs. The egg-stage probably lasts 10-11 days. The larvae reach maturity in 9-10 days; the first moult taking place a day after hatching, the others following at intervals of 1 or 2 days. The larvae are sluggish, unlike the adults which are restless and active flyers.

LEEFMANS (S.). **Levenswijze van een aan Orchideeën schadelijke** *Crioceris* **spec.** (*subpolita*, **Motsch.?**). [The Life-History of a *Crioceris* injurious to Orchids.]—*Treubia, Batavia*, i, no. 2, August 1919, pp. 82-89, 5 figs, 2 plates. [With an English summary.]

The egg, larva and adult of a Chrysomelid beetle, possibly *Crioceris subpolita*, Motsch., found in Java and Sumatra, are described. Both larvae and adults injure various kinds of orchids, eating the flowers by preference, but also the fruits and leaves. The eggs are laid on the flowers or flower-stems and hatch in 4-5 days. The freshly-hatched larva bears the egg-shell on its back during the first day, after which it becomes covered with a thick layer of its own faeces. In 9-10 days it reaches maturity, loosens the layer of excrement and constructs a cocoon of a white frothy substance attached to some part of the plant. Before pupating it remains inactive in the cocoon for 4-6 days. The pupal stage lasts 6-7 days and the beetle remains 2-3 days in the cocoon before emerging. The whole life-cycle thus lasts from 25 to 31 days.

ROEPKE (W.). **Mitteilung über die javanischen Maulwurfsgrillen (Orthoptera: fam. Gryllidae [Achetidae], subfam. Gryllotalpinen [Curtillinen]).** [A Communication on the Javanese Mole-Crickets.]—*Treubia, Batavia*, i, no. 2, August 1919, pp. 90-97, 1 fig., 1 plate.

The conclusion is arrived at that there are two species of mole-crickets in Java, *Gryllotalpa hirsuta*, Burm., and *G. africana*, P. B. At Buitenzorg all the males of *G. hirsuta* proved to be apterous and the females always macropterous. From Klaten an apterous female of *G. hirsuta* was received.

As regards *G. africana* there is only a small percentage of brachypterous males at Buitenzorg, and the females there are fully winged. From Klaten brachypterous males were received in comparatively large numbers and the females also included a small percentage of brachypterous individuals. There does not appear to be any previous record of brachypterous examples of *G. africana* or of apterous ones of *G. hirsuta*.

SCHENK (P. J.). **Vogelcultuur ten Bate van de Fruitteelt.** [The Breeding of Birds in Favour of Fruit Cultivation.]—*Tijdschr. Plantenziekten, Wageningen*, xxv, no. 5, September 1919, pp. 161-173.

The best method of fostering birds in fruit-growing districts are described.

DEN DOOP (J. E. A.). *Gallobelicus nicotianae*, **Koningsberger.**—*Bull. Deli Proefstation, Medan, Sumatra*, no. 12, August, 1919, 9 pp.

A preliminary note on *Gallobelicus nicotianae*, Koningsberger, a Capsid bug occurring on tobacco in Deli, has been published [see this *Review*, Ser. A, vii, p. 251]. The female oviposits in the leaves. The entire life-cycle is estimated to last 25–30 days. Immature individuals are wingless; in the last nymphal stage a pair of short wing-sheaths appear. Mating usually takes place in the morning, the sexes being about equal in number.

G. nicotianae is injurious in all its stages, the damage done being due to the punctures produced. In the morning feeding chiefly takes place on the upper surface of the leaves; later in the day the bugs seek shade and are to be found on the lower surface. Young leaves are preferred. When the leaves grow larger the punctures increase in size. The upper leaves are those chiefly attacked and it is unusual for the ten lowest leaves to be injured. Infestation is at its maximum at the end of May and beginning of June. The capture of these Capsids with nets has been recommended, but the individuals that fly up when disturbed represent one-seventh only of the total number. Furthermore tobacco is a short-lived crop, and by the time *G. nicotianae* appears in numbers, the plant has suffered permanent injury. This method may be of use in estates at higher altitudes, where the Capsids occur yearly and a careful watch is kept for their first appearance. Contact insecticides are usually employed against sucking insects, but as *G. nicotianae* is very mobile in all its stages, a stomach-poison is required. A number of experiments were made with arsenic acid, arsenious acid, copper sulphate, nicotine tartrate and strychnine tartrate, but none of these proved suitable. A fluid stomach-poison that will not repel the insects but rather attract them is necessary. It must act quickly and be non-injurious to tobacco.

SCHØYEN (T. H.). **Beretning om Skadeinsekter och Plantesykdommer i Land- og Havebruket 1918.** [Report on Insect Pests and Fungus Diseases of the Field and Orchard in 1918.]—*Christiania*, 1919, 71 pp., 44 figs.

Pests of cereals included wireworms, which did great damage all over the country; the larvae of *Blitophaga opaca*, L., damaging barley: *Trachea* (*Hadena*) *secalis*, Bjerk.; *T.* (*H.*) *basilinea*, F.; *Tipula oleracea*, L.; *Hylemyia coarctata*, Fall.; and *Hydrellia griseola*, Fall., which was very abundant on wheat as well as on barley and oats in many localities.

Oscinella frit, L., did very great damage to barley in 1917, its attacks being associated with a fungus, *Pleospora teres*, as well as *Miris dolabratus*, L., and *Pediculoides graminum*, E. Reut. During the summer of 1918 the devastation became still more widely spread in Hedmark. The first sign of attack was noticed on the 22nd June, at exactly the same time as during the previous year, a coincidence which is explained by almost identical climatic conditions, including long periods of drought that came to an end on 19th June in 1917 and on 18th June in 1918. Although the outbreak was more widespread in 1918 than in 1917, the injury caused to individual fields was greater in 1917, which is possibly explained by the fact that both

Miris dolabratus and *Pediculoides graminum* were much less common in 1918. The scarcity of these pests is probably due to the fact that both hibernate in the stubble and, as every straw was consumed as forage in 1917, were killed instead of, as in normal times, being conveyed with the straw to the fields in the manure. It is probable that the great extension of the cultivation of barley during the war is partly responsible for this outbreak, since this involved the ploughing up of much pasture land inhabited by the frit fly, which was consequently forced to attack barley. The flies of the first generation appear in May or June according to the climatic conditions, each female depositing about 60 eggs on the leaves of the young plants, preferably on oats and barley, but also on timothy and quickgrass. The young larvae penetrate into the axis of the plants, cutting off the stalk and causing the shoots to wither. At the base of these plants new shoots may appear, which, however, are very often attacked by flies of the first or the second generation and also succumb. The injury caused by the first generation is the more serious the more unfavourable the climatic conditions have been during the spring. The time of sowing therefore plays a very important part, and in Central Europe experience goes to show that the earliest sown plants usually escape injury, whereas the latest sown ones suffer heavily. Experience in Hedmark, however, is quite to the contrary, the latest sown fields as a rule escaping injury far better than those sown earlier. This depends on the climatic conditions prevailing during the spring in so far as that the latest sown plants appeared above the ground at exactly the time when rain set in, which rendered them far more resistant to attack than the earlier sown ones that had suffered from drought. During this great outbreak of the frit fly, it has been found that the oviposition period is comparatively long, the different stages as a consequence being found together. As a rule the flies of the second generation appear from the end of June to the beginning of July, attacking the new shoots or the spikes that have escaped the first generation. The flies of the third generation appear at the end of August and the beginning of September, ovipositing on autumn-sown cereals or, in the absence of these, on grasses. In order to prevent the attack of the third generation the sowing of autumn cereals as late as possible is suggested, though this procedure does not kill the fly, but only forces it to attack grasses. In order to kill a proportion of the hibernating adults sowing, as traps, strips of barley or rye and barley round the fields so early that the plants are ready for oviposition at the end of August is suggested. At the end of September these strips are ploughed and the larvae thus buried in the ground. Other cereal pests included: *Oscinella pusilla*, Meig., on oats; *Chlorops taeniopus*, Meig., on barley; *Aphis avenae*, L., *Macrosiphum granarium*, L., *Lygus pratensis*, L., *Thrips* sp., and the mites, *Pediculoides graminum*, E. Reut., and *Rhizoglyphus echinopus*, F. & R.

Grasses were attacked by *Charaeas graminis*, L., of which there had not been any outbreak since 1911, but which was very abundant in many parts of the country and did great injury; *Hepialus lupulinus*, L.; *Amaurosoma flavipes*, Fall.; *Hydrellia griseola*, Fall.; *Oscinella frit*, L.; and *Philaenus spumarius*, L.

Peas and beans were attacked by *Sitones lineatus*, L., which did great damage during the dry period at the beginning of the summer and a

thrips, probably *Kakothrips pisivorus*, Westw. (*Thrips robustus*, Uzel), was recorded from one locality. On potatoes *Cetonia aurata*, L., occurred in two localities, and *Gortyna* (*Hydroecia*) *micacea*, Esp., in another.

Pests of Cruciferous plants included *Julus londinensis*, wireworms, *Blitophaga opaca*, L., and *Haltica nemorum*, L., which last appeared in enormous numbers during the dry period in May and June. Drought being very favourable to these flea-beetles, the problem of combating them is partly one of retaining the moisture in the soil. This may be effected by heavy manuring and thorough working of the soil, as well as by spreading saltpetre on the top of the furrow immediately after the seed has been sown. In several instances arsenical sprays have been applied with great success. *Ceuthorrhynchus sulcicollis*, Gyll., *Pieris brassicae*, L., *P. napi*, L., *Polia* (*Barathra*) *oleracea*, L., and *Barathra brassicae*, L., were also recorded on cabbages, etc. *Plutella maculipennis*, Curt., appeared in great numbers, and it is considered likely that an outbreak of this moth will occur in 1919. *Eurydema oleraceum*, L., *Tipula oleracea*, L., and *Phorbia* (*Chortophila*) *brassicae*, Bch., were also reported.

Apple trees were attacked by *Xyleborus dispar*, F.; *Cantharis obscura*, L., which infested the blossoms; *Anthonomus pomorum*, L., which was present in exceptionally great numbers; *Aporia crataegi*, L.; *Hibernia defoliaria*, Cl.; *Cheimatobia brumata*, L.; *Argyroploce* (*Olethreutes*) *variegana*, Hb.; *Cydia pomonella*, L.; *Argyresthia conjugella*, Z.; *Hyponomeuta variabilis*, Z.; *Blastodacna atra*, Haw. (*putripennella*, Z.); *Leucoptera* (*Cemiostoma*) *scitella*, Z.; *Coleophora* sp.; *Cossus cossus*, L.; *Aphis pomi*, DeG.; *Psylla pyrisuga*, Först.; F.; *Taeniothrips inconsequens*, Uzel; *Euthrips pyri*, Dan.; *Thrips flavus*, Schr.; *Paratetranychus* (*Tetranychus*) *pilosus*, C. & F.; and *Eriophyes pyri*, Pgst.

Pests of pear trees, besides several of the foregoing, included *Melolontha hippocastani*, F.; Capsid bugs; *Eriocampoides limacina*, Retz.; *Contarinia* (*Diplosis*) *pyrivora*, Ril.; *Perrisia* (*Dasyneura*) *pyri*, Bch.; and *Paratetranychus pilosus*, C. & F.

Plums and cherries were attacked by *Cheimatobia brumata*, L.; *Cydia* (*Grapholitha*) *funebrana*, Tr.; *Hyalopterus arundinis*, F. (*pruni*, F.); *Tetranychus telarius*, L.; *Luperus rufipes*, L.; *Episema* (*Diloba*) *coeruleocephala*, L.; *Argyresthia ephippiella*, F.; *A. nitidella*; *Aphis cerasi*. Gooseberries were injured by *Pteronus* (*Nematus*) *ribesii*, Scop.; *Vanessa c-album*, L.; *Thamnonoma wavaria*, L.; and *Eulecanium* (*Lecanium*) *corni*, Bch.

On currants *Incurvaria capitella*, Cl., was more numerous than usual. The larvae of this moth hibernate when half grown and enter the buds in the spring, completely destroying them and often also excavating the young shoots. At the end of May they are full grown and pupate either in the ground or on the bushes. In June the moths appear and oviposit on the young berries, the young larvae entering the berries and destroying the seed. In the middle of July the larvae leave the berries and spin a white cocoon in which they hibernate. In experiments with a lime-sulphur winter spray, 82% of the larvae were killed, with paraffin emulsion 65%, and with nicotine 22%. When the attack is discovered in the spring, cutting off and burning the attacked buds and shoots is recommended. Leaves of black and red currants mined by the larvae of *Incurvaria pectinea*, Hb., were sent from one locality.

Other currant pests included: *Rhopalosiphum lactucae*, Kalt., and *Myzus ribis*, L. Raspberries were injured by *Byturus tomentosus* F., *Haltica rubi*, Payk., and *Lasioptera rubi*, Heeg.; and strawberries by *Julus londinensis*, *Otiorrhynchus sulcatus*, F., *Dolycoris baccarum*, L., and *Tarsonemus fragariae*, Zimm.

ROSTRUP (Sofie). **Jordlopperna.** [Flea-Beetles.]—*Vort Landbrug, Copenhagen*, xxxviii, no. 17, 1919.

On account of the serious devastation caused by flea-beetles in Denmark an investigation was made by sending inquiries to farmers in July 1918, and the following is a condensed report of the answers received with regard to the circumstances under which the outbreaks took place. The attacks occurred all over the islands and in the eastern and northern part of Jylland, the middle and western part escaping. The injury was most severe on the islands, especially on Sjaelland, where 50% of the fields mentioned in the reports were completely devastated, whereas on Jylland the corresponding number was only sixteen. All cruciferous plants were attacked, and resowing had to be resorted to over a large area. The attack often originated in fields with cruciferous weeds. In about 40% of the fields the attack started during the germination period, in the rest after the plants had appeared above the ground. The degree of injury decreased with the nature of the soil in the following order:—clay, heavy loam, sandy loam and sand. In Jylland ploughing took place to the same extent both in autumn and spring; on the islands, on the other hand, more than half of the fields were ploughed in the autumn and only a few both in autumn and spring. On the islands the attack was a little more serious on the fields ploughed in spring, while in Jylland there was very little difference between the fields ploughed at different times, infestation being less in fields ploughed both in autumn and in spring.

The moisture in the soil on the islands was greatest in the fields ploughed during winter and least in those ploughed both in autumn and spring. As was expected, the attack proved least severe where the moisture was greatest. On Jylland no connection between the degree of injury and the time of ploughing or the amount of moisture in the soil could be detected. Spring manuring on Jylland did not increase the injury caused by flea-beetles, whereas on the islands greater damage was done where this was carried out. The condition of the soil was found greatly to influence the degree of injury, more so on the islands than on Jylland. When the soil was finely pulverised and contained a suitable amount of moisture, the injury was far less than when it was lumpy and dry. As regards the influence of the time of sowing, it was found that on the islands the attack was a little more severe on those fields sown in May than on those sown in April; on Jylland the injury increased as the date of sowing advanced from the end of April to the 20th May but, remarkably enough, decreased when the sowing took place during the last 10 days of May. Most of the answers emphasise the fact that in 1918 the sowing took place too late, and early sowing or, in the case of turnips, very late sowing in June, is strongly recommended.

On Jylland 59% of the fields were rolled, on the islands only 33%. When they were not rolled, the attack was much more serious, and

this was especially the case on light soils, where the percentage of infestation was twice as high when they had not been rolled. Many farmers also favour rolling the fields because hoeing the weeds then can begin before the plants appear above the ground, and because germination is furthered by this method and the drying up of the soil prevented. Hoeing the weeds before the plants appear has proved a very good measure for controlling flea-beetles.

JACKSON (Miss D. J.). **Further Notes on Aphides collected principally in the Scottish Highlands.**— *Scot. Naturalist, Edinburgh*, no. 93-94, September-October 1919, pp. 157-165, 2 figs.

This list of Aphids includes: *Macrosiphum dirhodum*, Wlk., on roses under glass in September; *M. epilobii*, Theo., on terminal shoots of willow herb (*Epilobium*) in August; *M. granarium*, Kirby, on oats in September; *M. lactucae*, Schr., on currant and gooseberry in September; *M. millefolii*, F., on *Achillea millefolium* in August; *Acyrthosiphon* (*M.*) *pisi*, Kalt., on broad beans and clover from June to July and on beans and vetch in September; *M. rosae*, L., on roses under glass in September; *Amphorophora ampullata*, Buckt., on the undersurface of fern leaves in September; *Drepanosiphum platanoides*, Schr., on the undersurface of leaves of sycamore (*Acer*) in September and preyed upon by Cecidomyid larvae; *Rhopalosiphum britteni*, Theo., on gooseberry and currant in September; *Rhopalosiphum lactucae*, Kalt., on gooseberry in August, many individuals having been killed by the fungi *Empusa* (*Entomophthora*) *aphidis*, and *E.* (*Triplosporium*) *fresenii*; *R. persicae*, Sulz., on the undersurface of potato leaves in September, many being killed by *Empusa fresenii*; *Hyalopterus flavus*, Kittel (*aquilegiae*, Koch, *trirhodus*, Wlk.), on columbine (*Aquilegia*) in July and September and preyed upon by Syrphid and Cecidomyid larvae; *Aphis adjecta*, Wlk., on chrysanthenum in July, parasitised by a Chalcid, and also on *Eryngium alpinum* in September; *A. cardui*, L., on thistle (*Cnicus arvensis* ?) in August; *A. grossulariae*, Kalt., on gooseberry in September; *A. ilicis*, Kalt., on holly in September; *A. myosotidis*, Koch, on *Myosotis* in July; *A. pruni*, Réaumur, on plum in July; *A. rumicis*, L., on leeks in August; *A. viburni*, Scop., on *Viburnum* in September; *A. achilleae*, F., redescribed from examples taken on *Achillea millefolium* in August; *Myzus crataegi*, Wlk., on hawthorn in July, many being killed by Cecidomyid larvae; *M. kaltenbachi*, Schon., on grass in July; *M. lactucae*, L., on currant in July; *M. solani*, Kalt., on potato leaves in September; *M. whitei*, Theo., on gooseberry in August, when it was attacked by *Empusa fresenii*, and also on currant in September; *Callipterus quercus*, Kalt., on oak in September; *Eucallipterus tiliae*, L., on lime in September; *Chaitophorus aceris*, L., on sycamore in September; *Lachnus costata*, Zett., (*fasciatus*, Burm.) on spruce (*Picea excelsa*) in July; *Lachniella cilicica*, Del G., on silver fir (*Abies pectinata*) in September; *L. juniperi*, F., on juniper in Kent in July; *L. laricis*, Wlk., on larch in June, July and September; *L. pichtae*, Mordw., on *Abies pectinata* in September; *L. pini*, L., on Scotch fir (*Pinus sylvestris*) in July; *L. pinicola*, Kalt. (*abietis*, Wlk.) on *Picea excelsa* in July; *L. pini-habitans*, Mordw., on *Pinus sylvestris* in September; *Eulachnus agilis*, Kalt., on needles of Austrian pine (*Pinus laricio* var. *austriaca*) in July

and on *P. sylvestris* in August and September; *Eriosoma lanigerum*, Haus., on elm in September; and *Thecabius affinis*, Kalt., on buttercup (*Ranunculus*) in July.

BAGNALL (R. S.). **Brief Descriptions of new Thysanoptera. X.**—*Ann. & Mag. Nat. Hist., London*, iv, no. 22, October 1919, pp. 253–277.

The new thrips described include: *Aeolothrips fulvicollis* on flowers of *Verbascum* in India; *Ceratothrips gowdeyi* on flowers of *Solanum* sp. in Uganda; *Tryphactothrips roboris* on flowers of *Thunbergia laurifolia* in the Gold Coast; *Heliothrips bicinctus* associated with *H. femoralis* on various plants in hot-houses in England and Belgium, and also with *H. haemorrhoidalis* on bananas in Spain; *H. pattersoni* on *Granadilla* leaves in the Gold Coast; *H. minutissimus* on violets in India; *Dendrothrips indicus* on leaves of arrowroot in India; *Frankliniella varicornis* on *Petalostemon purpureum* in Canada; *Euthrips citricinctus* on arrowroot leaves in India; *E. cameroni* on injured wheat stems in Canada; *Haplothrips pictipes* on diseased pepper berries in India; and *Padothrips varicornis* on flowers of sugar-bush (*Protea*) in South Africa.

ROARK (R. C.). **Plants used as Insecticides.**—*Amer. Jl. Pharmacy, Philadelphia*, xci, nos. 1 & 2, January and February, 1919, pp. 25–37 and 91–107.

This annotated list, representing 135 genera, calls attention to promising insecticidal plants for further investigations. The desirability of finding new insecticides is pointed out, especially as the present prices of arsenicals, pyrethrum, etc., are so high. The majority of the plants listed probably have no commercial value at present, and many are troublesome or dangerous weeds, and if they could be used for insecticidal purposes, a market would be found for material that is at present valueless or even the cause of direct loss, *e.g.*, from stock poisoning.

It is stated that tons of roots of *Veratrum viride* are used annually in preparing hellebore, and that during the fiscal year 1916–17 more than £10,000 worth of the flowers of *Chrysanthemum cinerariaefolium* were imported into the United States.

BAKER (A. C.). **Fitch's Thorn Leaf Aphis.**—*Proc. Biol. Soc. Washington, D. C.*, xxxii, no. 37, 30th September 1919, pp. 185–186.

The mention of *Aphis crataegifoliae*, Fitch [see this *Review*, Ser. A, vi, pp. 212, 420] has resulted in many enquiries by entomologists in regard to this name and that of *A. brevis*, Sanderson. Recent comparisons show that *A. brevis* is a synonym of *A. crataegifoliae*, which is a distinct species from *A. bakeri*, Cow. *A. crataegifoliae* should further be placed in the genus *Anuraphis*, as also its close relative *A. bakeri*, both these species living on rosaceous plants and migrating to clover during the summer.

The Angoumois Grain Moth Poster.—*Wkly. Press Bull., Pennsylvania Dept. Agric., Harrisburg*, iv, no. 41, 16th October 1919, 1 p.

As the Angoumois grain moth [*Sitotroga cerealella*] causes an annual damage of over £200,000 in Pennsylvania, large posters are being

distributed in the infested counties describing its life-history. The remedial measures advocated are the early threshing of grain, which should be stored in deep tight bins in a granary away from the barn. Threshed grain should be fumigated with carbon bisulphide at the rate of one pint (1 pound) to each 100 bushels of grain or from 6 to 8 lb. to each 1,000 cubic feet of space occupied by the grain. To prevent the adults emerging and returning to the fields all infested grain should be disposed of before 15th May and the barns thoroughly cleaned out.

WHITEHOUSE (F. C.). **Entomological Report.**—*Ann. Rept. Dept. Agric. Alberta 1918, Edmonton*, 1919, pp. 152–153. [Received 28th October 1919.]

Grain Aphids and cutworms were very abundant on field crops during 1918 in Alberta. Garden pests included: *Euxoa ochrogaster* (red-backed cutworm); *Hylemyia antiqua* (onion maggot); Aphids; a spruce mite, which may be controlled by spraying with summer strength lime-sulphur or with water under pressure; *Haltica bimarginata* (alder flea-beetle); *Malacosoma disstria* (forest tent caterpillar); Western wheat-stem sawfly [*Cephus occidentalis*]; sugar beet webworm [*Loxostege sticticalis*], which caused serious damage to cabbage, beets, peas, etc.; and the red turnip beetle [*Entomoscelis adonidis*], which did serious injury to cauliflowers, cabbages, turnips and radishes.

CAESAR (L.). **Orchard Insects in Ontario in 1919.**—*Canadian Horticulturist, Toronto*, xlii, no. 10, October 1919, pp. 241–242.

The codling moth [*Cydia pomonella*] was very abundant during the year under review; even in well-sprayed orchards the damage amounted to 50% of the crop. The cherry and pear slug [*Eriocampoides limacina*] was also very numerous. Other pests included the cigar case-bearer [*Coleophora fletcherella*], against which sprays are most satisfactory if applied before the blossoms burst; the pear psylla [*Psylla pyricola*], against which a delayed dormant spray, containing 1 gal. of lime-sulphur to 8 or 9 gals. of water followed by the codling moth spray containing 40% nicotine sulphate, proved most effective.

LEGISLATION.

Loi du 25 Septembre 1919 instituant des Syndicats obligatoires pour la Défense contre les Sauterelles en Algérie.—*Jl. d'Agric. Pratique, Paris*, xxxii, no. 36, 9th October 1919, pp. 725–726.

By an amendment of the law of 24th December 1888, concerning the destruction of insects, fungi, etc., the extermination of locusts in Algeria will be carried out in conformity with a new law which provides for the establishment of local syndicates, of which all cultivators of the soil will be compulsory members, to ensure the universal execution of proper remedial measures. The cost of such measures is to be provided for by the State.

ERRATA.

Page	14	line	41	for "*Pinaspis*"	read	"*Pinnaspis.*"
	20	,,	9	,, "*Parleptomastix*"	,,	"*Paraleptomastix.*"
	20	,,	27	,, "*Ophionectra*"	,,	"*Ophionectria.*"
	21	,,	39	,, "*Gallium*"	,,	"*Galium.*"
	39	,,	46	,, "*variegata*"	,,	"*lineaticollis.*"
	43	,,	46	,, "*heracliana*"	,,	"*heracleana.*"
	44	,,	27	,, "*Caligrapha*"	,,	"*Calligrapha.*"
	61	,,	41	,, "Armitage (A.H.M.)"	,,	"Armitage (H.M.)."
	68	,,	11	,, "Pettit (H. R.)"	,,	"Pettit (R. H.)."
	70	,,	9	,, "*dolobratus*"	,,	"*dolabratus.*"
	85	,,	31	,, "*Clirina*"	,,	"*Clicina.*"
	87	,,	25	,, "Buckt."	,,	"Licht."
	88	,,	21	,, "xiv"	,,	"xiii."
	96	,,	44	,, "*captoris*"	,,	"*captorius.*"
	109	,,	24	,, "378"	,,	"373."
	110	,,	28	,, "*adula*"	,,	"*radula.*"
	118	,,	19	,, "*Phylocalyx*"	,,	"*Phyllocalyx.*"
	126	,,	6	,, "*thoantides*"	,,	"*thoantiades.*"
	135	,,	21	,, "*Holococera*"	,,	"*Holcocera.*"
	183	,,	28	,, "*Syanthedon*"	,,	"*Synanthedon.*"
	203	,,	3	,, "*Cotinis*"	,,	"*Cotinus.*"
	218	,,	42	,, "*Phyladelphus*"	,,	"*Philadelphus.*"
	221	,,	27	,, "Ser. A, vi, p. 455"	,,	"Ser. A, vii, p. 80."
	231	,,	27	,, "*Aterix*"	,,	"*Atherix.*"
	237	,,	35	,, "*aurantiae*"	,,	"*aurantii.*"
	249	,,	17	,, "*Pilocrosis*"	,,	"*Pilocrocis.*"
	250	,,	26	,, "$\frac{1}{25}$"	,,	"$\frac{1}{125}$"
	252	,,	28	,, "*Aprostocerus*"	,,	"*Aprostocetus.*"
	257	,,	9	,, "*Euchenopa*"	,,	"*Enchenopa.*"
	274	,,	12	,, "*Metzeneria*"	,,	"*Metzneria.*"
	281	,,	37	,, "McCollock (J. W.)"	,,	"McColloch (J.W.)"
	283	,,	9	,, "Hawley (J. M.)"	,,	"Hawley (I. M.)."
	295	,,	17	,, "*Psilogaster faxiiventris*"	,,	"*Psilogaster fasciiventris.*"
	300	,,	11	,, "(*Ips balsameus*, Lec.)"	,,	"(*Pityokteines sparsus*, Lec.)."
	310	,,	34	,, "*O. consanguinana*"	,,	"*A. consanguinana.*"
	330	,,	30	,, "(*Colcophora inequalis*)"	,,	"(*Coelophora inequalis*)."
	344	,,	32	,, "*Myzodes*"	,,	"*Myzoides.*"
	344	,,	35	,, "*ostreaeiformis*"	,,	"*ostreaeformis.*"
	350	,,	1	,, "*Signphora*"	,,	"*Signiphora.*"
	356	,,	45	,, "arcissus"	,,	"Narcissus."
	369	,,	15	,, "Moore"	,,	"Walker."
	387	,,	6	,, "*cowani*"	,,	"*coweni.*"
	389	,,	16	,, "*Mellisoblaptes*"	,,	"*Melissoblaptes.*"

ERRATA.—*cont.*

Page	line		
Page 394	line 12	for "(*Adoretus umbrosus tenuimaculatus*)"	read "(*Popillia japonica*, Newm.)."
,, 402	,, 39	,, "*monacantha*"	,, "*monocantha*."
,, 403	,, 15	,, "*Estigmena*"	,, "*Estigmene*."
,, 408	,, 23	,, delete "with oil."	
,, 418	,, 44	,, "(*Lagerotroemia indica*)"	,, "(*Lagerstroemia indica*)."
,, 434	,, 33	,, "*creatomiae*"	,, "*ceratomiae*."
,, 437	,, 1	,, "*Tephrites*"	,, "*Tephritis*."
,, 437	,, 11	,, "*Bothrochacis*"	,, "*Bothrochalcis*."
,, 437	,, 27 & 41	for "*krauhniae*"	,, "*kraunhiae*."
,, 440	,, 11	for "*E. echinopus*"	,, "*R. echinopus*."
,, 446	,, 12	,, "*devastratix*"	,, "*devastatrix*."
,, 446	,, 43	,, "*Macrosiphon*"	,, "*Macrosiphum*."
,, 468	,, 29	,, "*mamatus*"	,, "*hamatus*."
,, 469	,, 2	,, "*M. euonymellus*"	,, "*H. euonymellus*."
,, 481	,, 8	,, "Vinal (S. C.)"	,, "Vinal (S. A.)."
,, 481	,, 15	,, "*nyoidea*"	,, "*myoidea*."
,, 505	,, 46	,, "Anstead (D. R.)"	,, "Anstead (R. D.)."
,, 510	,, 10	,, "Burrell"	,, "Burrill."
,, 520	,, 3	,, "*Ricania* in Ceylon"	,, "*Ricania* on tea in Ceylon."
,, 535	,, 27	,, "*deodora*"	,, "*deodara*."

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GENERAL INDEX.

In the case of scientific names the page reference is cited only under the heading of the generic name.

When a generic name is printed in brackets it signifies that the name is not adopted.

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